



# CITY OF TROY DAM REMOVAL STUDY

Meeting

March 24, 2020

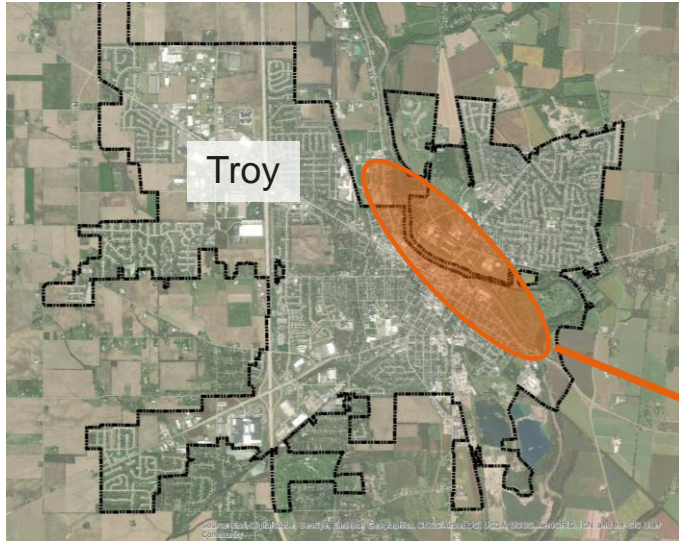
# Agenda



## **Study Scope:**

- **Groundwater Model Updates**
- **River Study / River Refinement**
- **Recharge Impacts Assessment**
- **Plume Impacts Study**

# City of Troy Water Supply

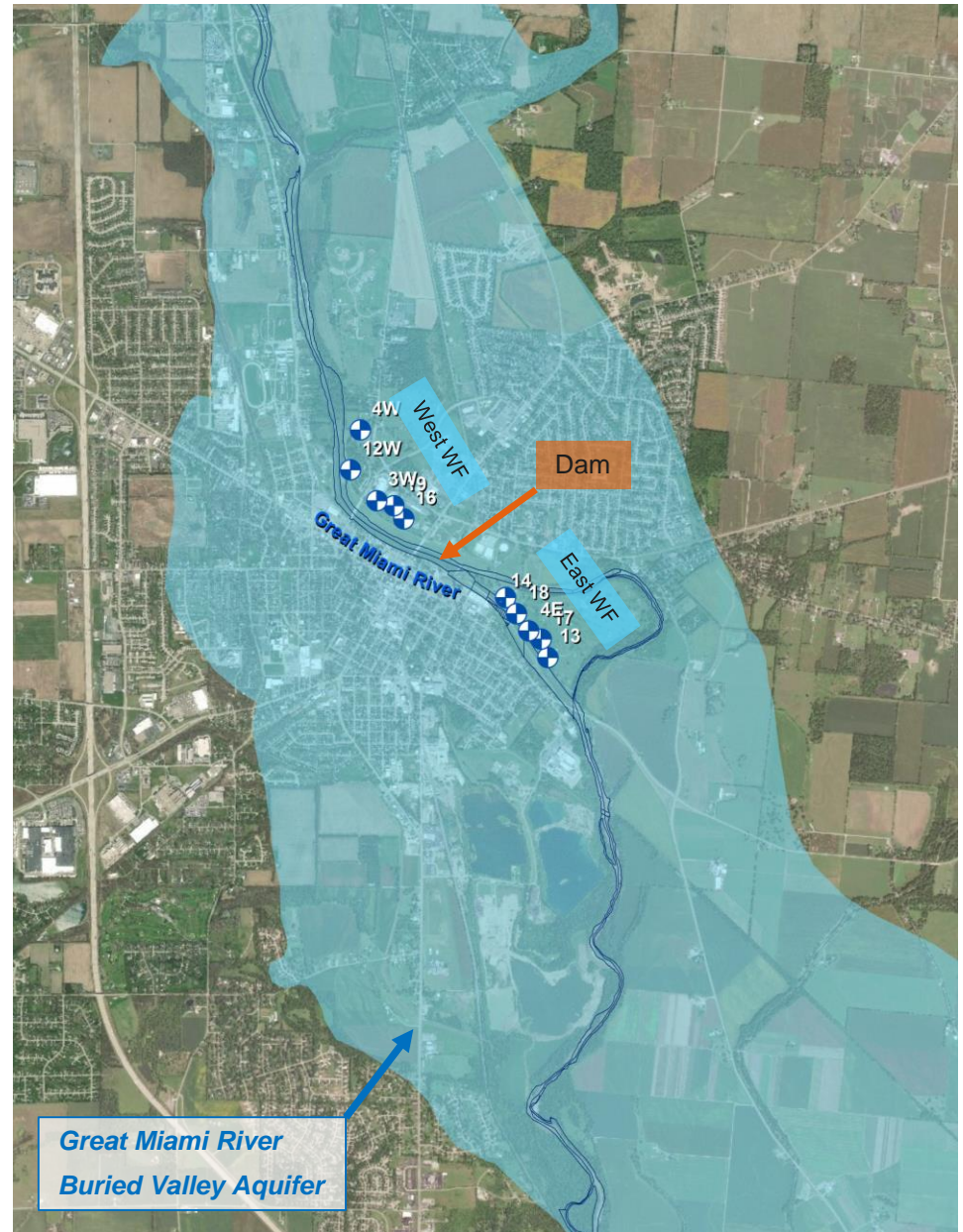


- City supplied by groundwater from 2 Well Fields along Great Miami River
- Very near to Troy low-head dam



# Well Field Recharge Concerns

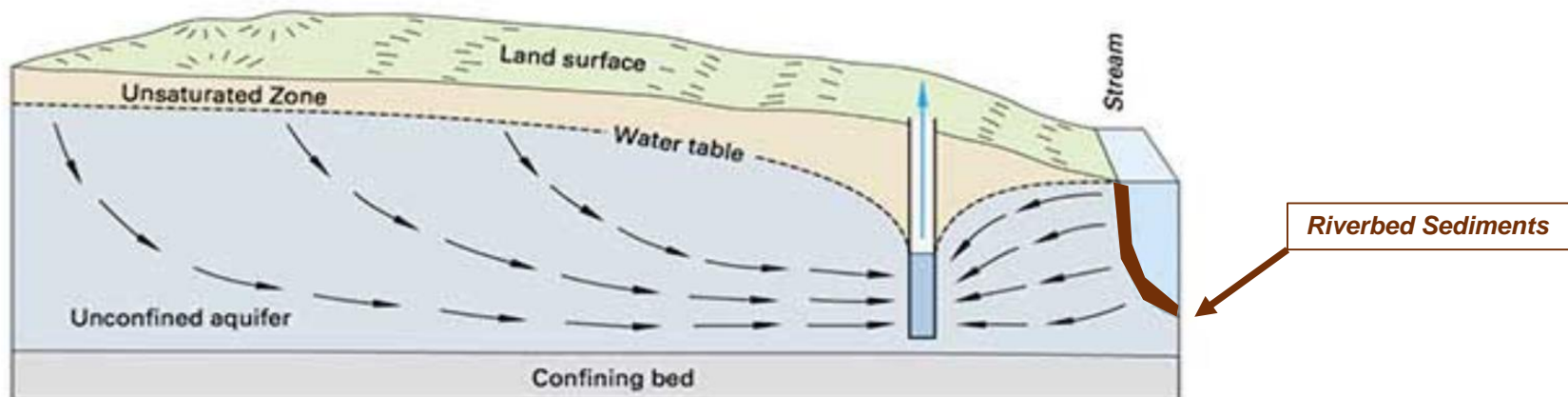
- Well Fields draw water from Great Miami River Buried Valley Aquifer
- River traverses the length of the aquifer
- River and aquifer are connected.
  - Well fields are recharged by water from the river
  - Changes to river could reduce recharge/capacity of well fields



# Recharge from River

- Well Fields are recharged by the river
- Quantity of recharge (i.e. productivity of well field) is controlled by:
  1. Water level of River (relative to groundwater level)
  2. Permeability of riverbed sediments and stage of river.

Recharge Schematic



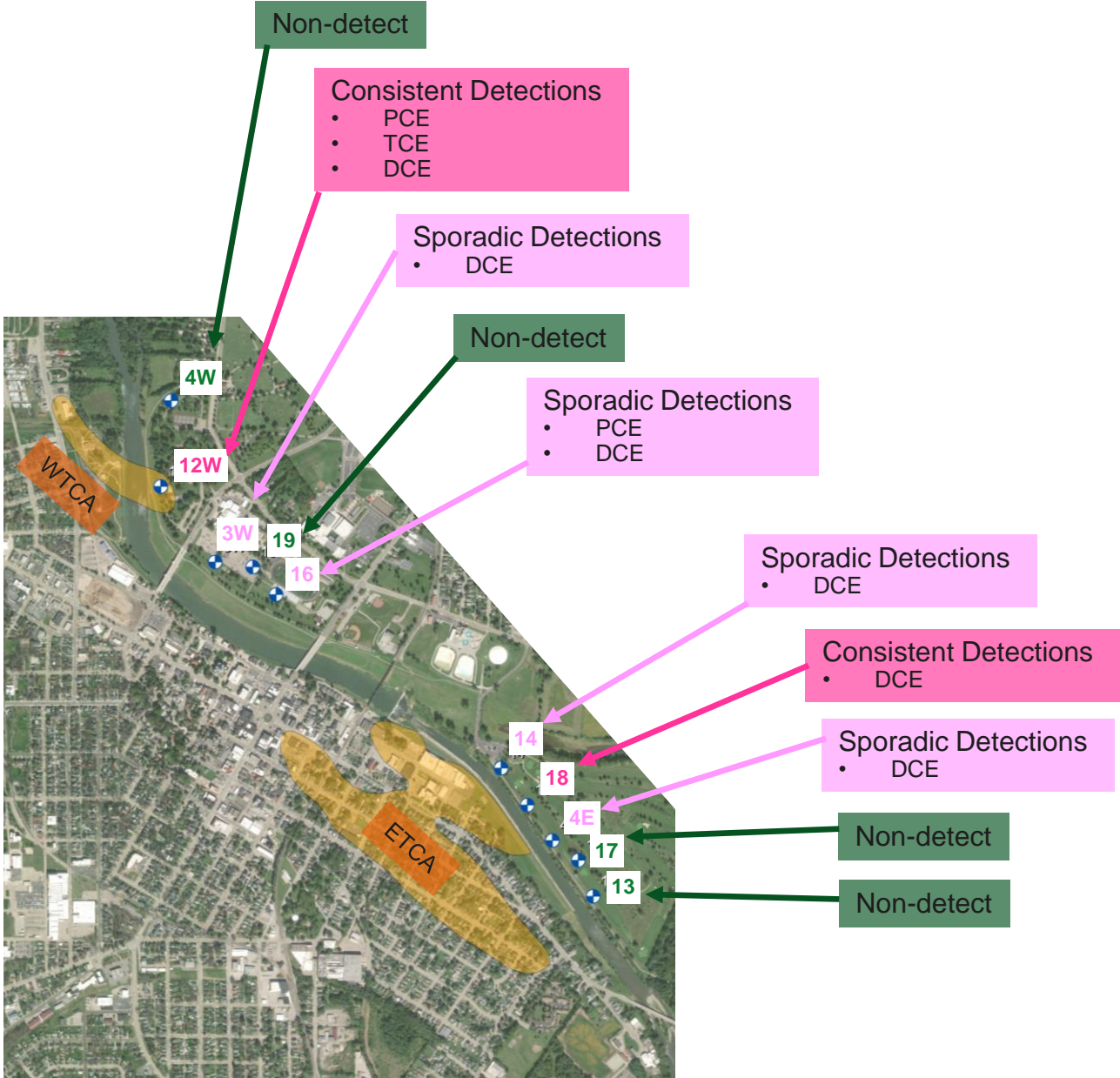


# Contaminant Plume Concerns

- 2 Contaminated sites recently placed on USEPA's Superfund list
  - West Troy Contaminated Aquifer Site
  - East Troy Contaminated Aquifer Site
- USEPA has been active in investigating the sources of contamination, but no remedy is in place
- Both sites are currently impacting Troy's well fields
- Troy has been managing contaminants through blending and treatment and is able to produce contaminant free finished water
- Changes to the river could cause increased concentrations in the production wells or bypass of the treatment system.

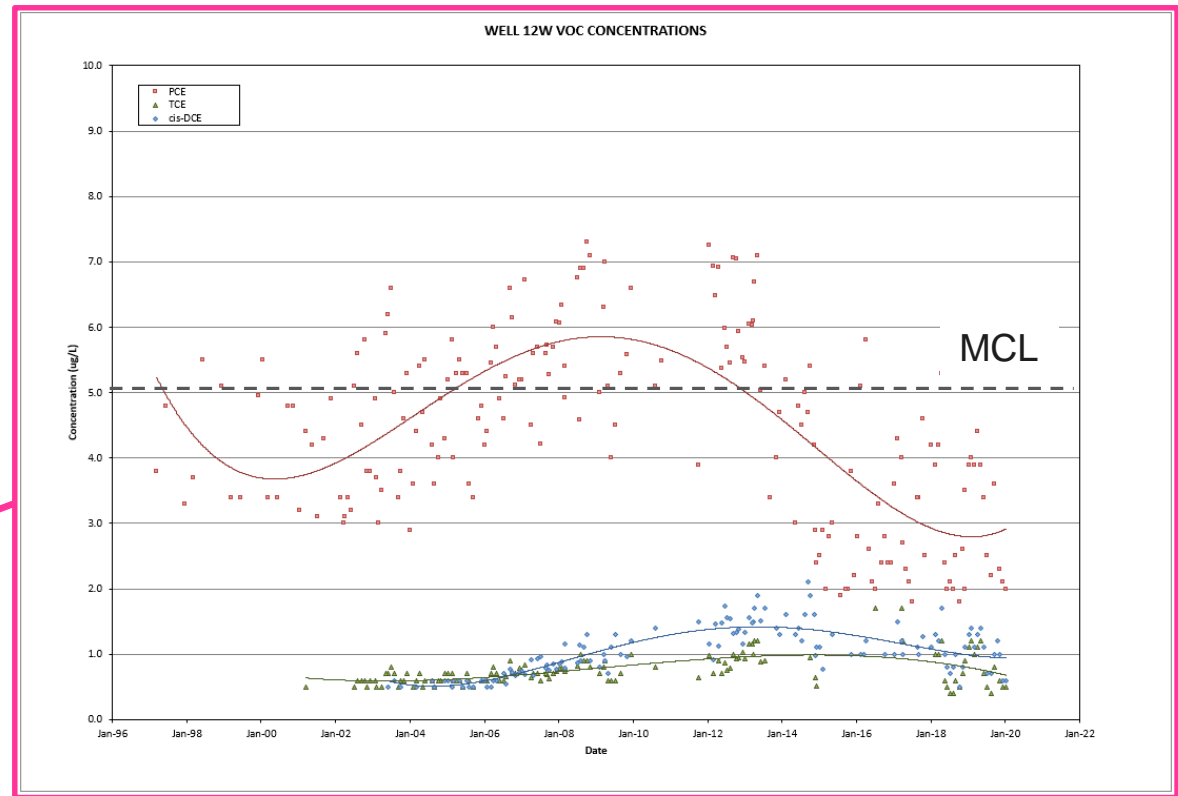
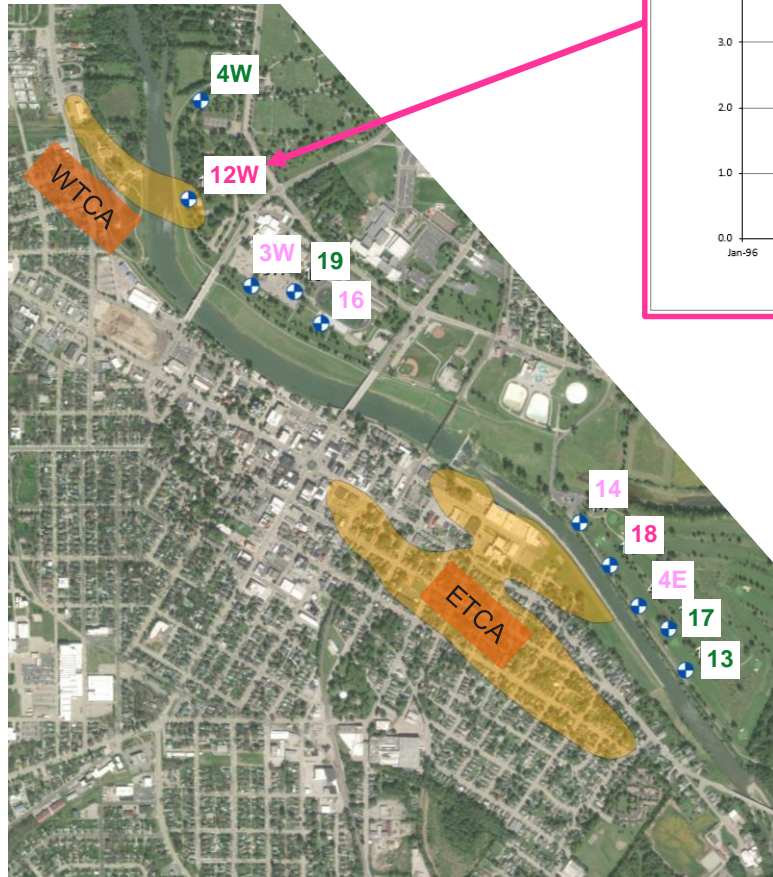


# Troy Impacted Wells





# Well 12W



- 12W is the only well with concentrations above MCLs
- Air stripping tower installed on well to remove contaminants

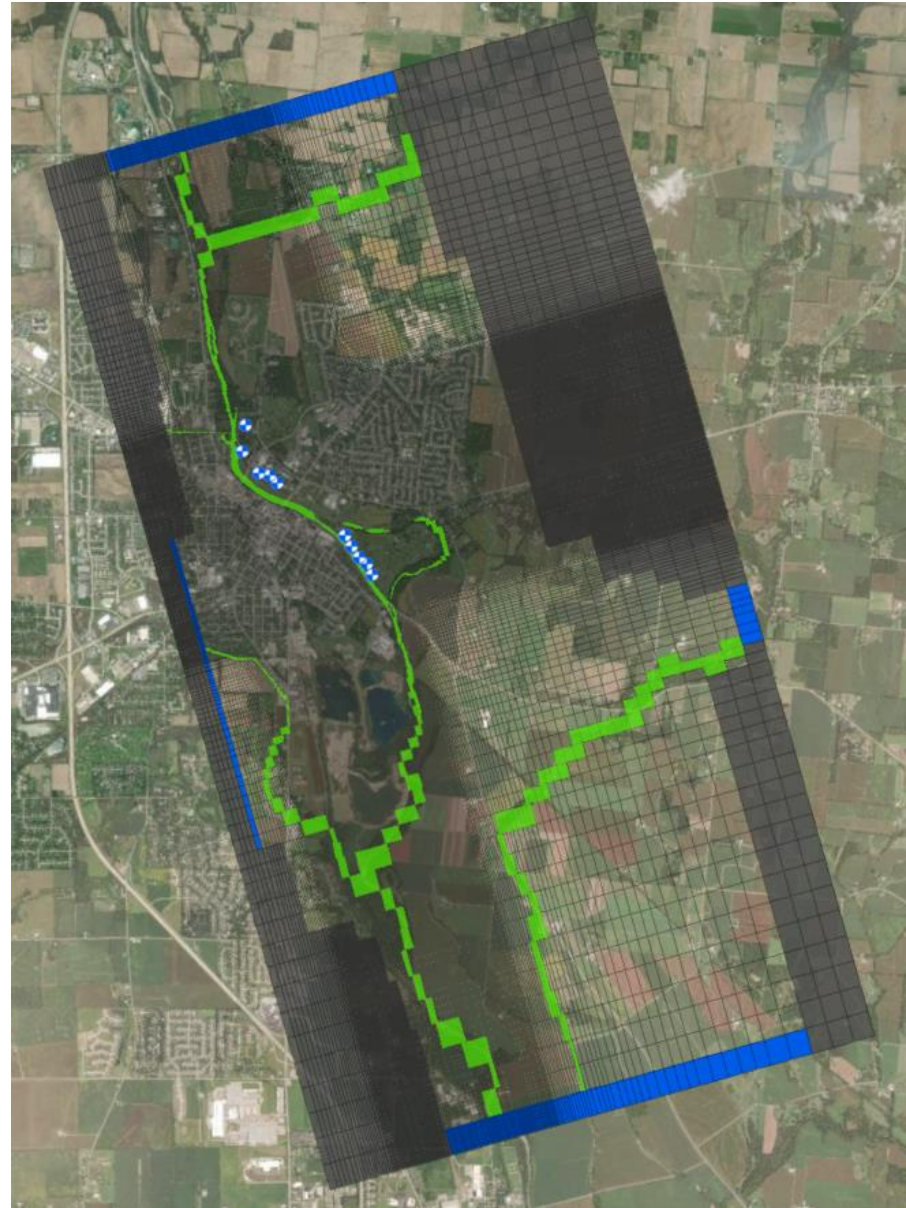


- Groundwater flow modeling study
  - Troy maintains a groundwater flow model that also simulates the influence of the Great Miami River.
- Model Updates Refinements
  - Update Geology: Information from USEPA investigations.
  - Update River: Flatland Resources survey and proposed changes in river.
  - Update Plumes: USEPA Investigation
- Model Simulations
  - Evaluate changes in plume migration, well capture zones, and river recharge from current condition to proposed dam removal conditions



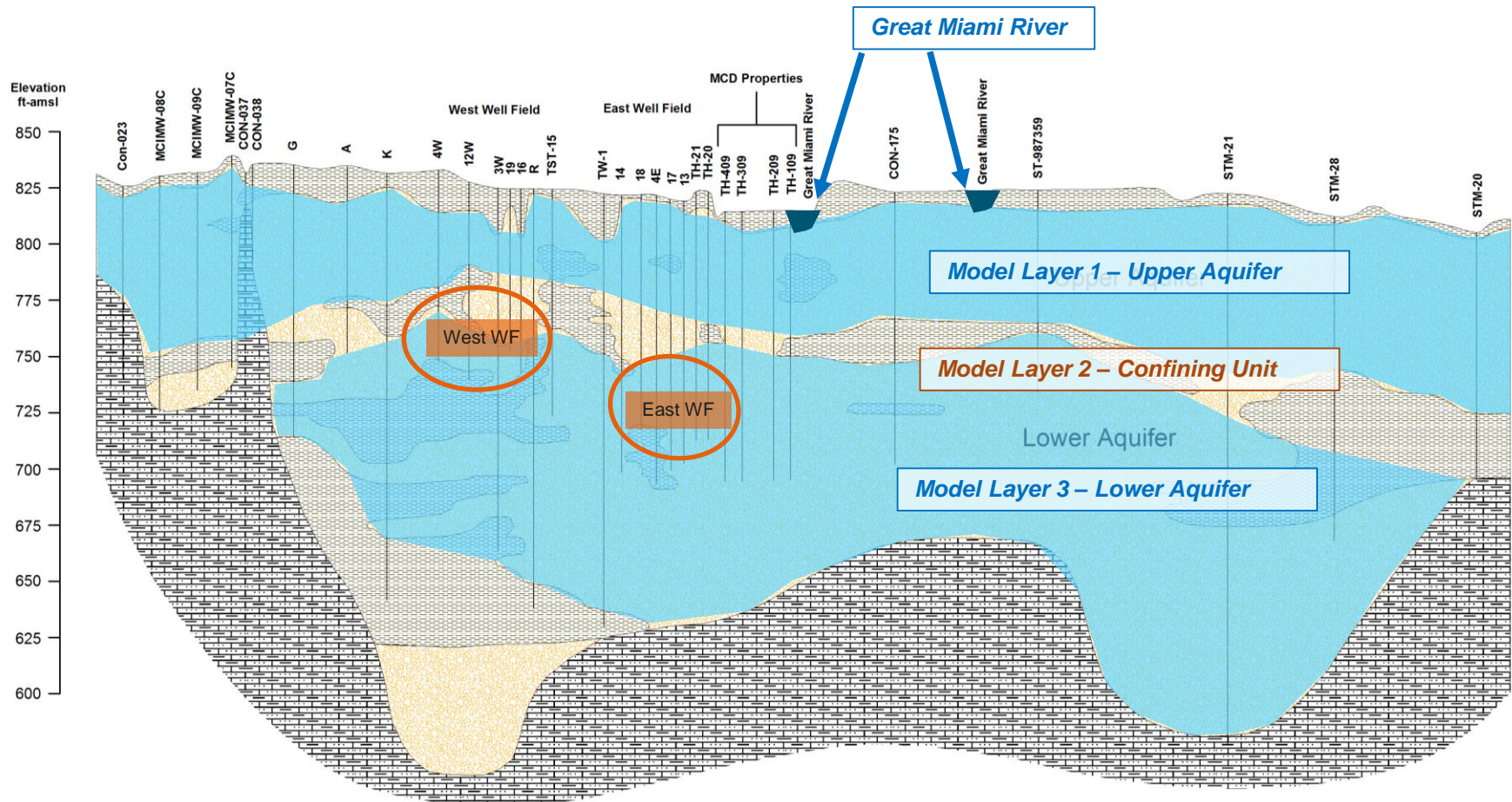
# Model Refinements

- Model Refinements
  - Model grid made finer in well field/plume area for increased resolution
  - Tributary streams added
  - 2 new model layers added





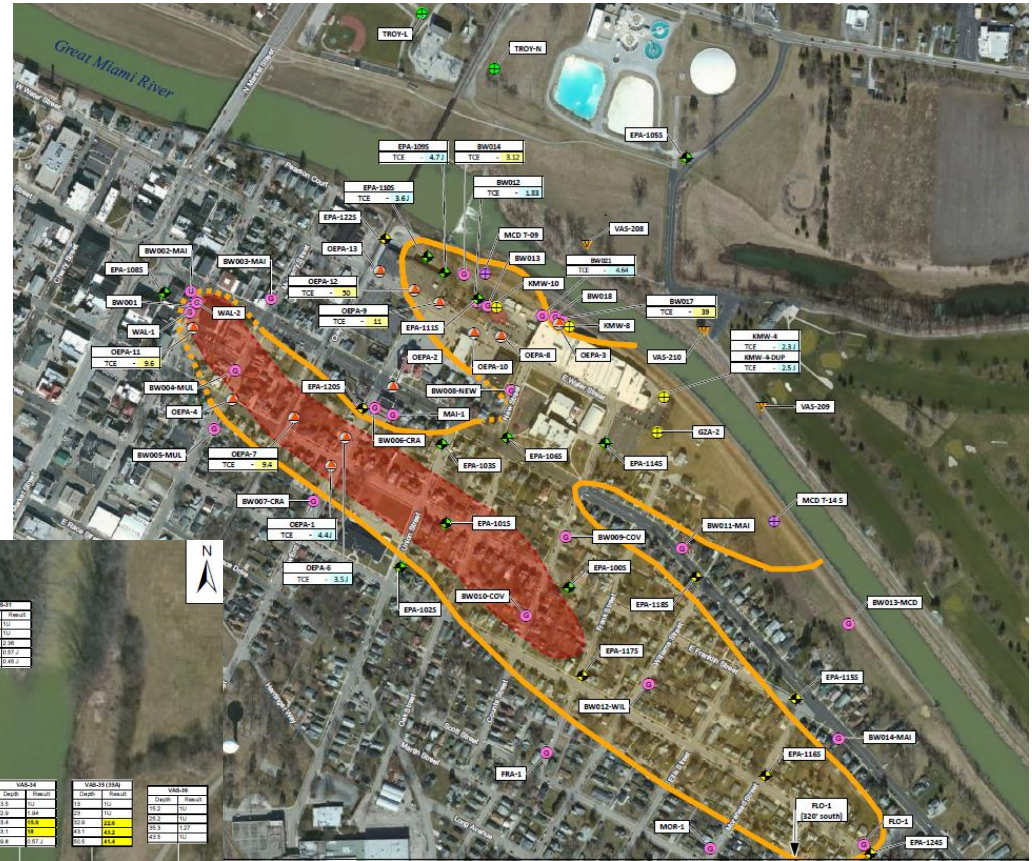
# Aquifer System





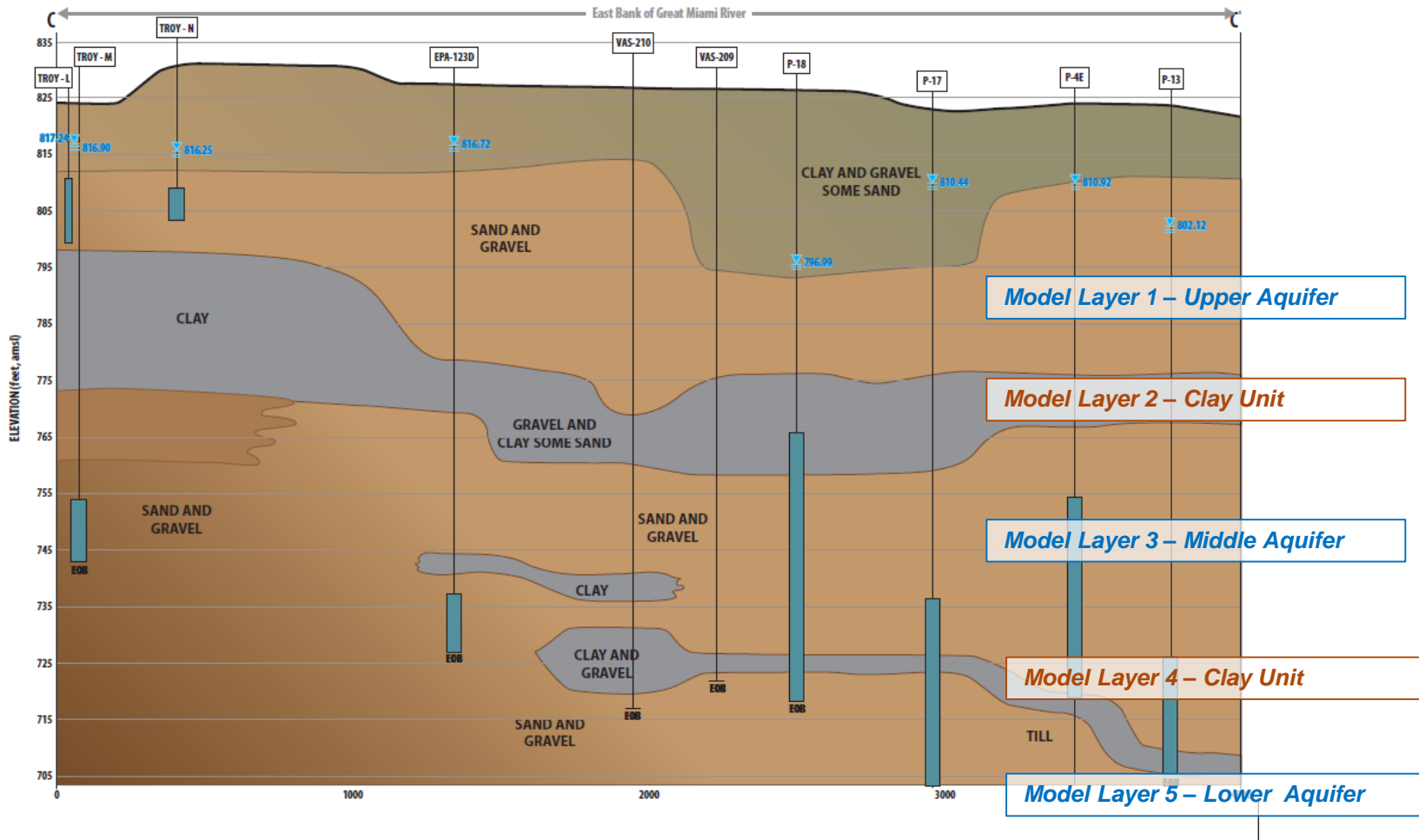
The map displays a residential area with a proposed road layout. A pink line indicates a new road or driveway, and yellow arrows show traffic flow. Numerous data tables are overlaid on the map, providing details for various road segments and intersections. The tables include columns for 'Depth' and 'Flow' in both directions. The map shows a residential neighborhood with houses, trees, and a road network. A pink line starts from the bottom left, curves through the center, and ends at the top right. Yellow arrows indicate the direction of traffic flow along the pink line and at various intersections. The data tables provide specific values for each segment, such as 'Depth' and 'Flow' in both directions. The tables are labeled with codes like VMD-01, VMD-02, etc., and some include additional information like 'Flow' and 'Flow2'.

Code	Depth	Flow	Flow2
VMD-01	15.0	15.0	15.0
VMD-02	15.0	15.0	15.0
VMD-03	15.0	15.0	15.0
VMD-04	15.0	15.0	15.0
VMD-05	15.0	15.0	15.0
VMD-06	15.0	15.0	15.0
VMD-07	15.0	15.0	15.0
VMD-08	15.0	15.0	15.0
VMD-09	15.0	15.0	15.0
VMD-10	15.0	15.0	15.0
VMD-11	15.0	15.0	15.0
VMD-12	15.0	15.0	15.0
VMD-13	15.0	15.0	15.0
VMD-14	15.0	15.0	15.0
VMD-15	15.0	15.0	15.0
VMD-16	15.0	15.0	15.0
VMD-17	15.0	15.0	15.0
VMD-18	15.0	15.0	15.0
VMD-19	15.0	15.0	15.0
VMD-20	15.0	15.0	15.0
VMD-21	15.0	15.0	15.0
VMD-22	15.0	15.0	15.0
VMD-23	15.0	15.0	15.0
VMD-24	15.0	15.0	15.0
VMD-25	15.0	15.0	15.0
VMD-26	15.0	15.0	15.0
VMD-27	15.0	15.0	15.0
VMD-28	15.0	15.0	15.0
VMD-29	15.0	15.0	15.0
VMD-30	15.0	15.0	15.0
VMD-31	15.0	15.0	15.0
VMD-32	15.0	15.0	15.0
VMD-33	15.0	15.0	15.0
VMD-34	15.0	15.0	15.0
VMD-35	15.0	15.0	15.0
VMD-36	15.0	15.0	15.0
VMD-37	15.0	15.0	15.0
VMD-38	15.0	15.0	15.0
VMD-39	15.0	15.0	15.0
VMD-40	15.0	15.0	15.0
VMD-41	15.0	15.0	15.0
VMD-42	15.0	15.0	15.0
VMD-43	15.0	15.0	15.0
VMD-44	15.0	15.0	15.0
VMD-45	15.0	15.0	15.0
VMD-46	15.0	15.0	15.0
VMD-47	15.0	15.0	15.0
VMD-48	15.0	15.0	15.0
VMD-49	15.0	15.0	15.0
VMD-50	15.0	15.0	15.0
VMD-51	15.0	15.0	15.0
VMD-52	15.0	15.0	15.0
VMD-53	15.0	15.0	15.0
VMD-54	15.0	15.0	15.0
VMD-55	15.0	15.0	15.0
VMD-56	15.0	15.0	15.0
VMD-57	15.0	15.0	15.0
VMD-58	15.0	15.0	15.0
VMD-59	15.0	15.0	15.0
VMD-60	15.0	15.0	15.0
VMD-61	15.0	15.0	15.0
VMD-62	15.0	15.0	15.0
VMD-63	15.0	15.0	15.0
VMD-64	15.0	15.0	15.0
VMD-65	15.0	15.0	15.0
VMD-66	15.0	15.0	15.0
VMD-67	15.0	15.0	15.0
VMD-68	15.0	15.0	15.0
VMD-69	15.0	15.0	15.0
VMD-70	15.0	15.0	15.0
VMD-71	15.0	15.0	15.0
VMD-72	15.0	15.0	15.0
VMD-73	15.0	15.0	15.0
VMD-74	15.0	15.0	15.0
VMD-75	15.0	15.0	15.0
VMD-76	15.0	15.0	15.0
VMD-77	15.0	15.0	15.0
VMD-78	15.0	15.0	15.0
VMD-79			



- East Troy Plume Area

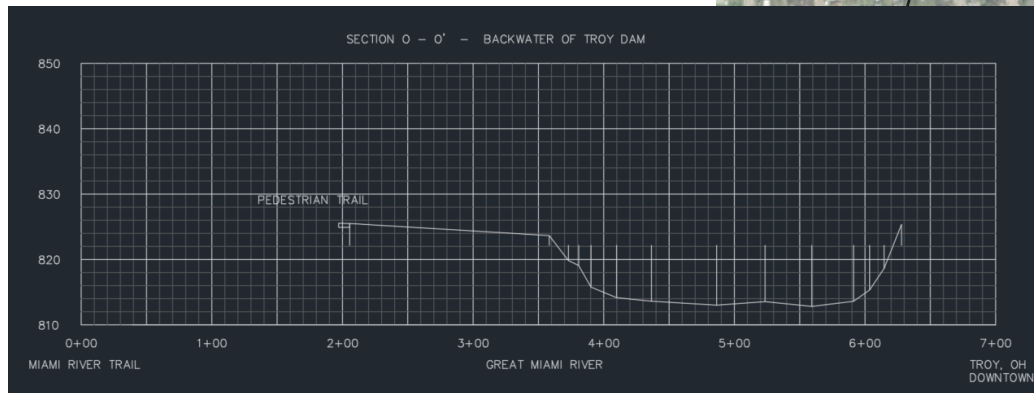
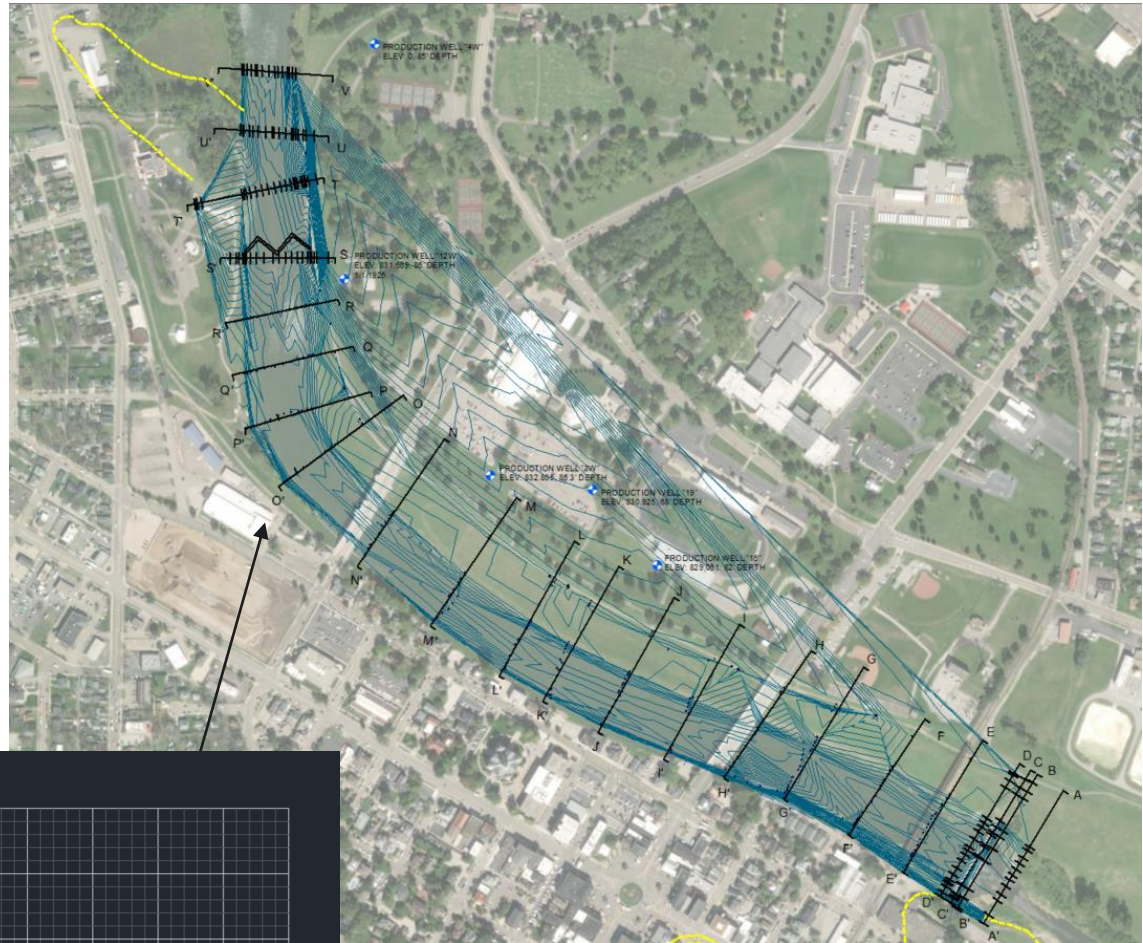
- East Troy Plume Area**





## Flatland Resources Study of the River

- Surveyed elevation of water surface at cross section locations (interpolation in-between)
- Surveyed contours of bottom of river channel

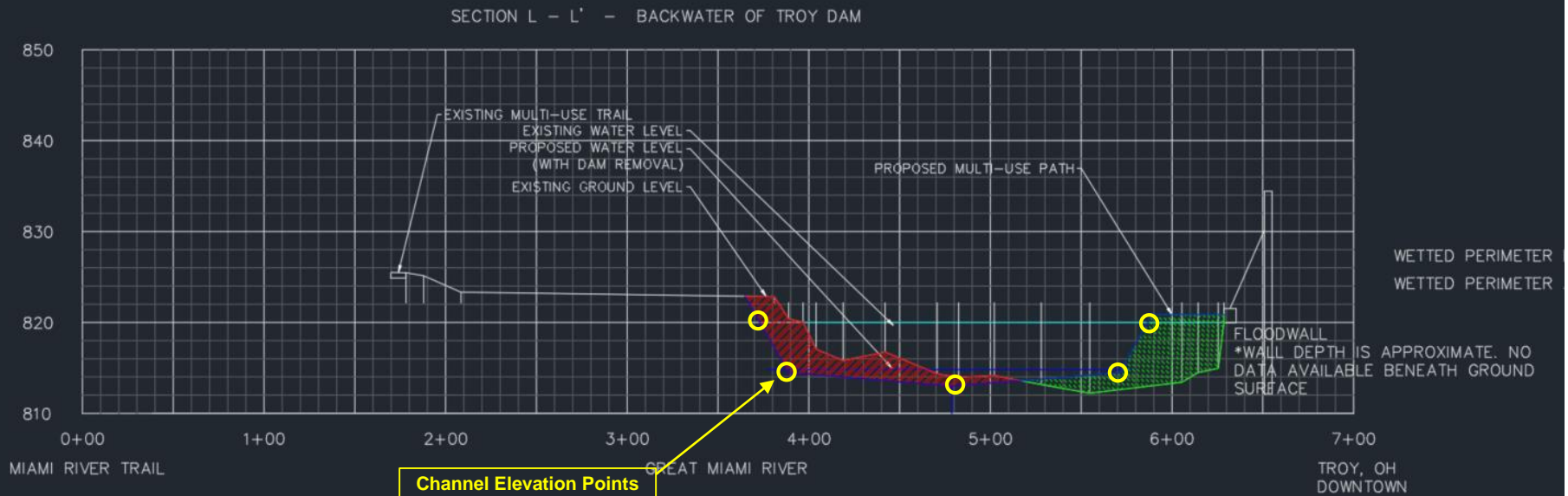




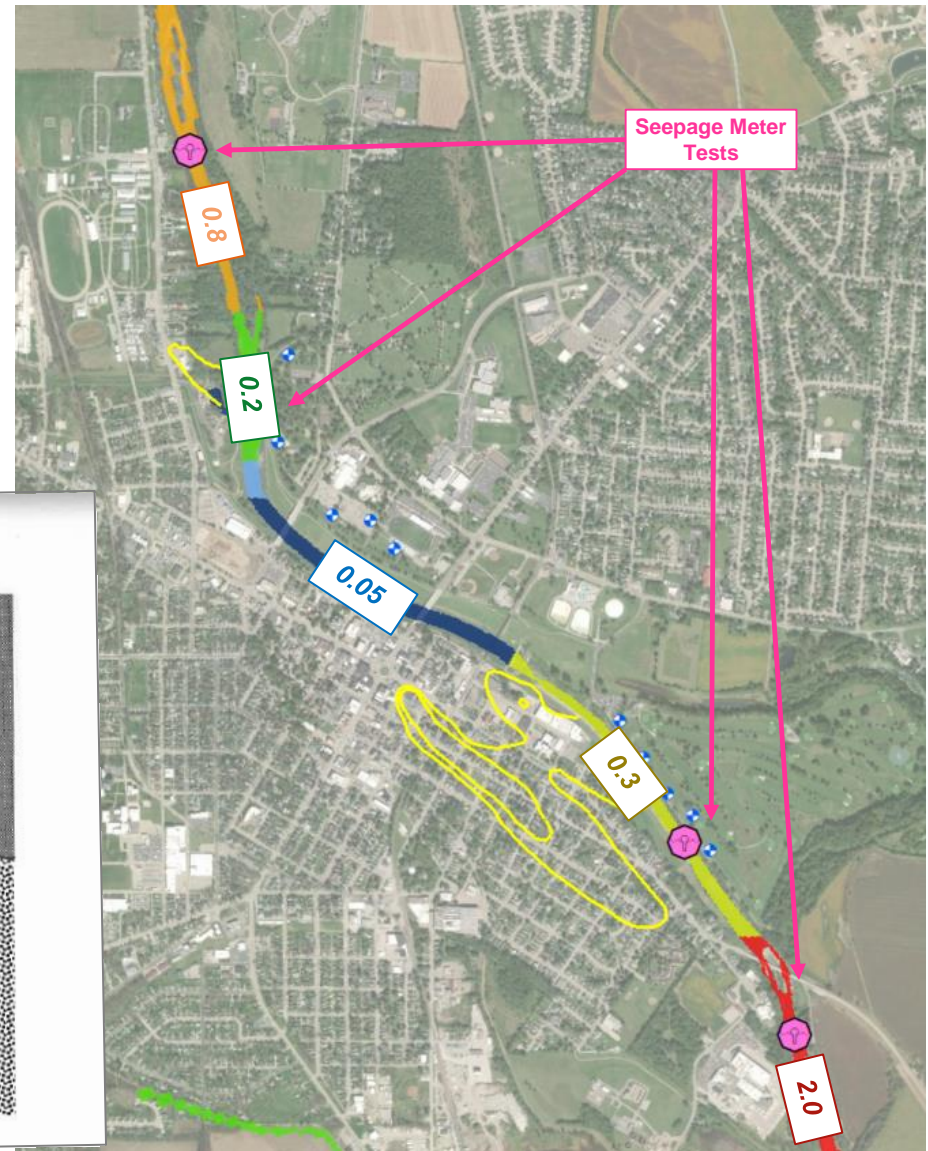
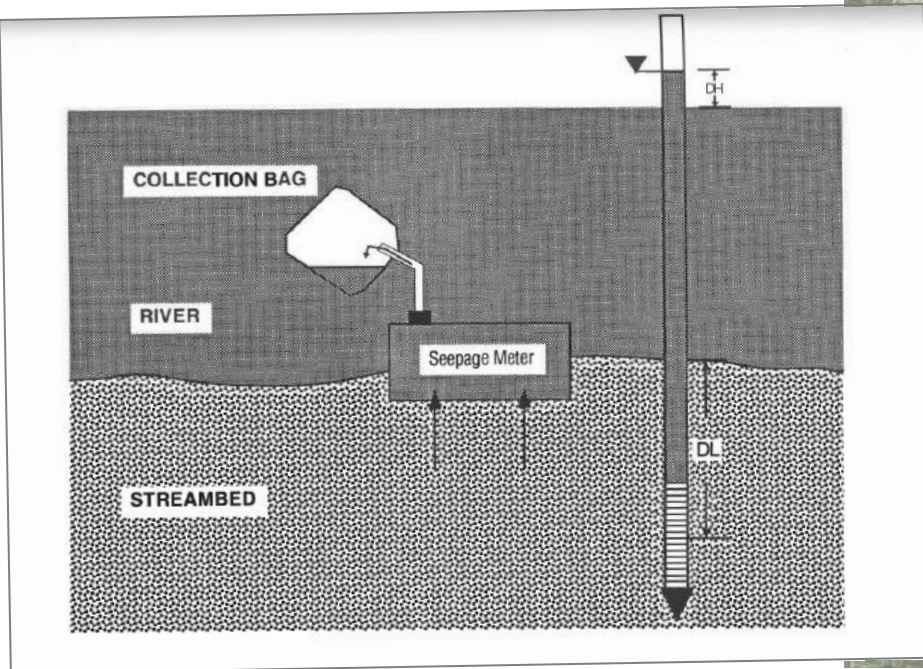
# Refinement of River – Predicted

## Flatland Resources: Predicted Channel of River After Dam Removal

- Water Surface Maintenance Structure
- Predicted Idealized Channel Bottom
- Predicted Water Level



- Direct Measure of Riverbed Permeability
- 4 Locations
- Range: **0.05 to 2.0 ft/day**
- Used to assign model value  
(adjusted during calibration)



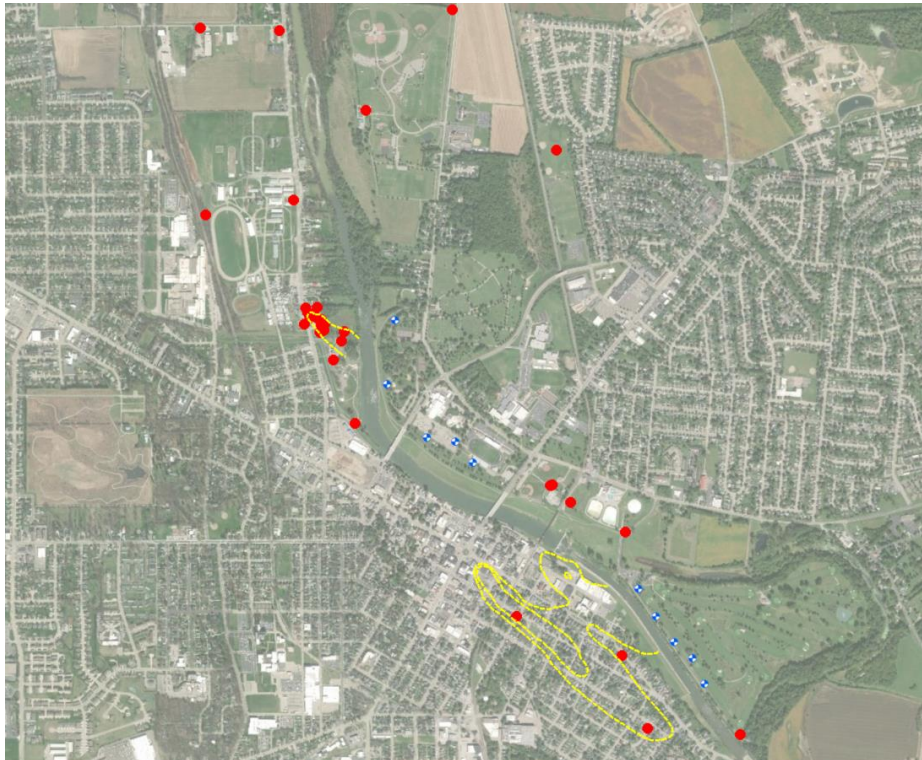


- **Calibrated Model to Groundwater Elevation Measurements**

- Ensures the model reasonably simulates actual conditions in the aquifer
- Selected most recent water level events by USEPA
- Selected time when river was relatively stable.

## **West Troy**

- October 6, 2016 USEPA Water Level Event (17 wells)
- October 6, 2016 City of Troy Water Level Event (18 wells)



## **East Troy**

- February 25, 2013 USEPA Water Level Event (74 wells)





# Seasonal Conditions

## Summer

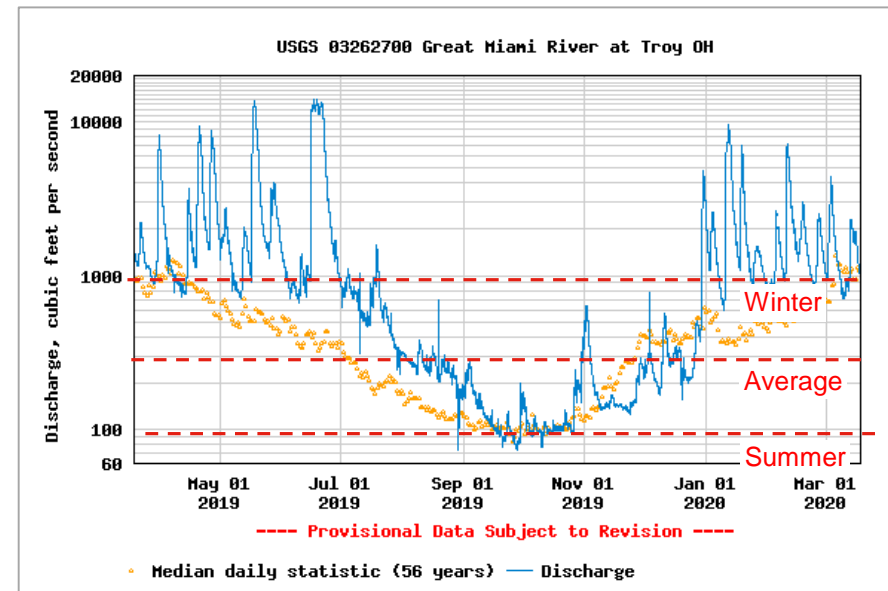
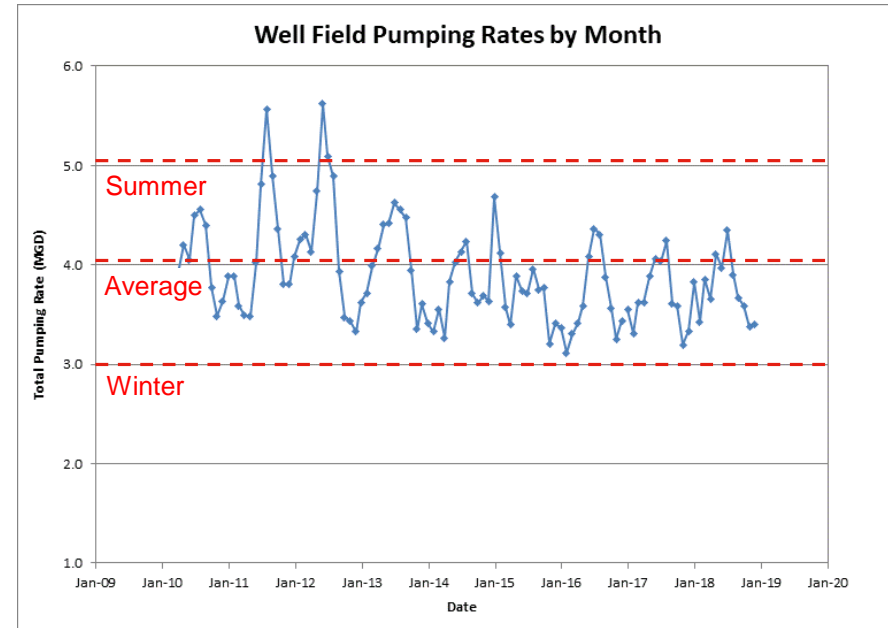
- Maximum Monthly Pumping from Well Fields (5 MGD)
- Median River Stage for Summer
- Low Recharge from Precipitation (4 inches)

## Average Conditions

- Average Pumping from Well Fields (4 MGD)
- Average River Level
- Average Recharge from Precipitation (10 inches)

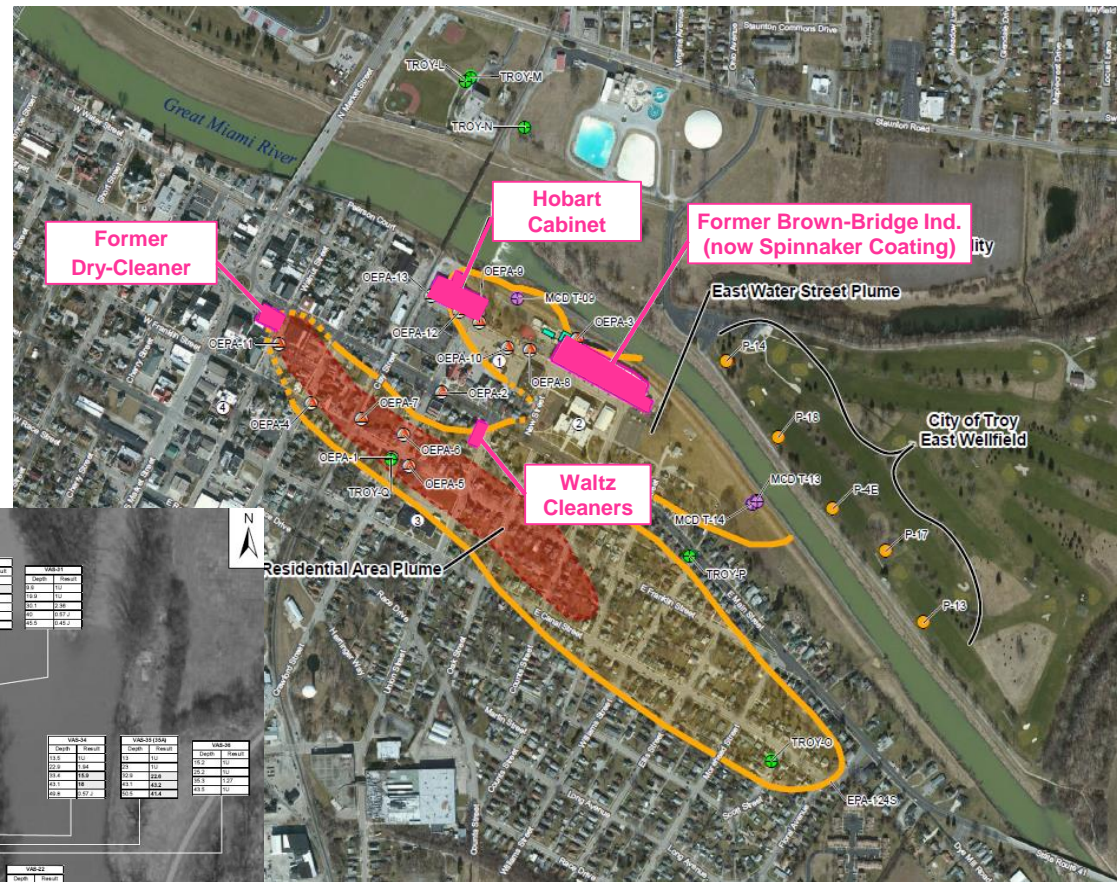
## Winter

- Minimum Monthly Pumping from Well Fields (3 MGD)
- Median River Stage for Winter
- High Recharge from Precipitation (13 inches)



# Plume Sources

- East Troy Plume Area



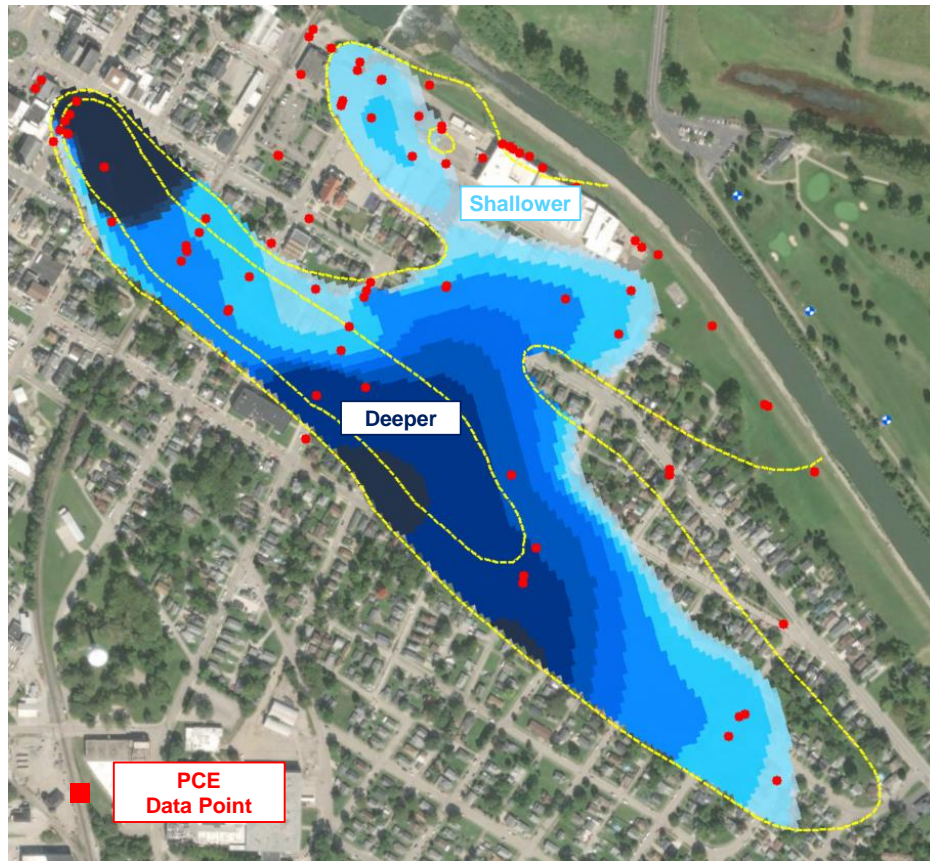
- West Troy Plume Area





# Plume Extents

- East Troy – PCE Plume by Depth (>5 PPB)



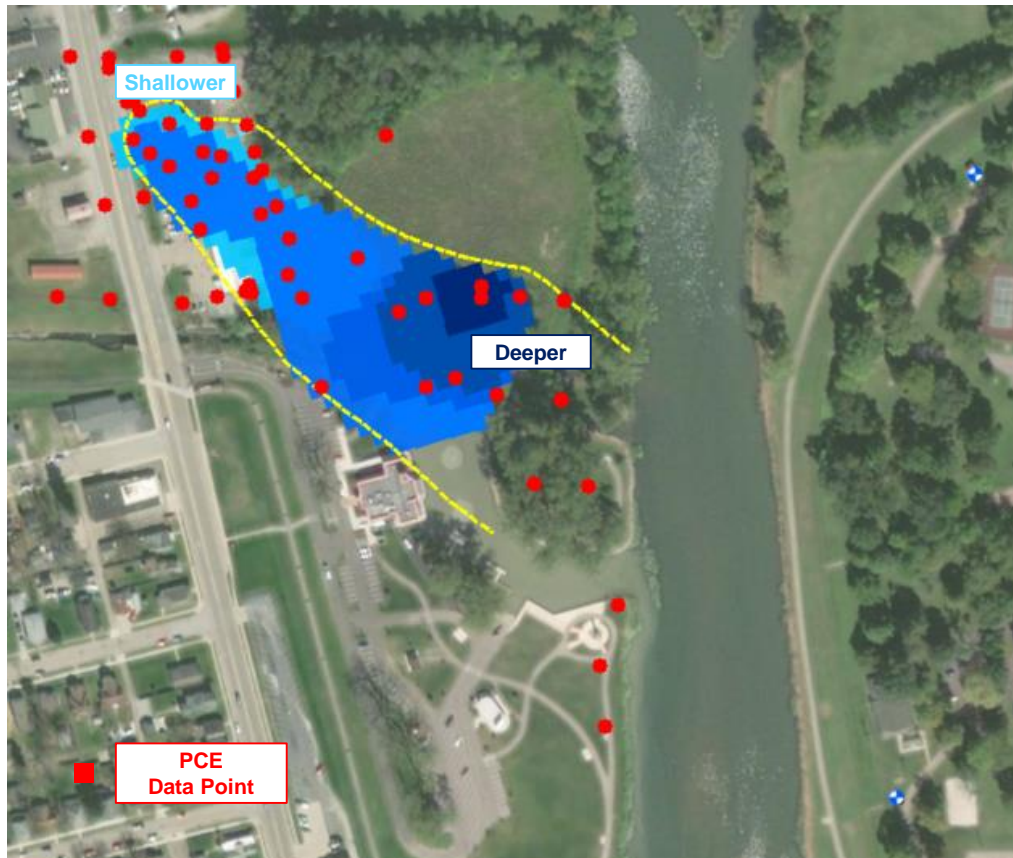
- East Troy – Cis DCE Plume (>5 PPB)





# Plume Extents – East Troy CA

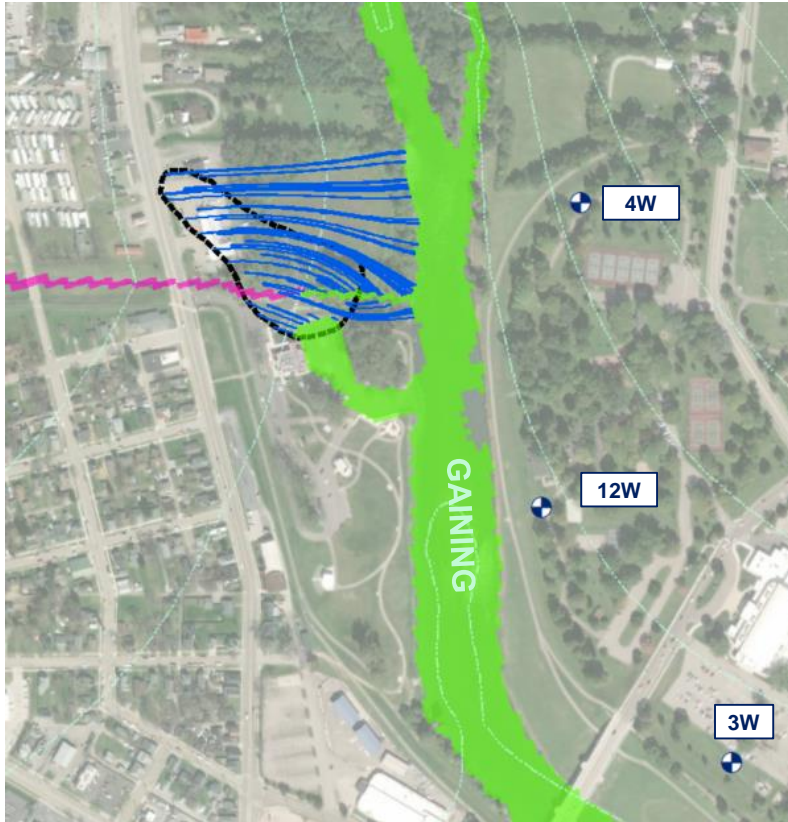
- East Troy – PCE Plume by Depth (>5 PPB)



# No Pumping Scenario – Pre Dam Removal

- How would plumes migrate if the Well Fields were Not Pumping?

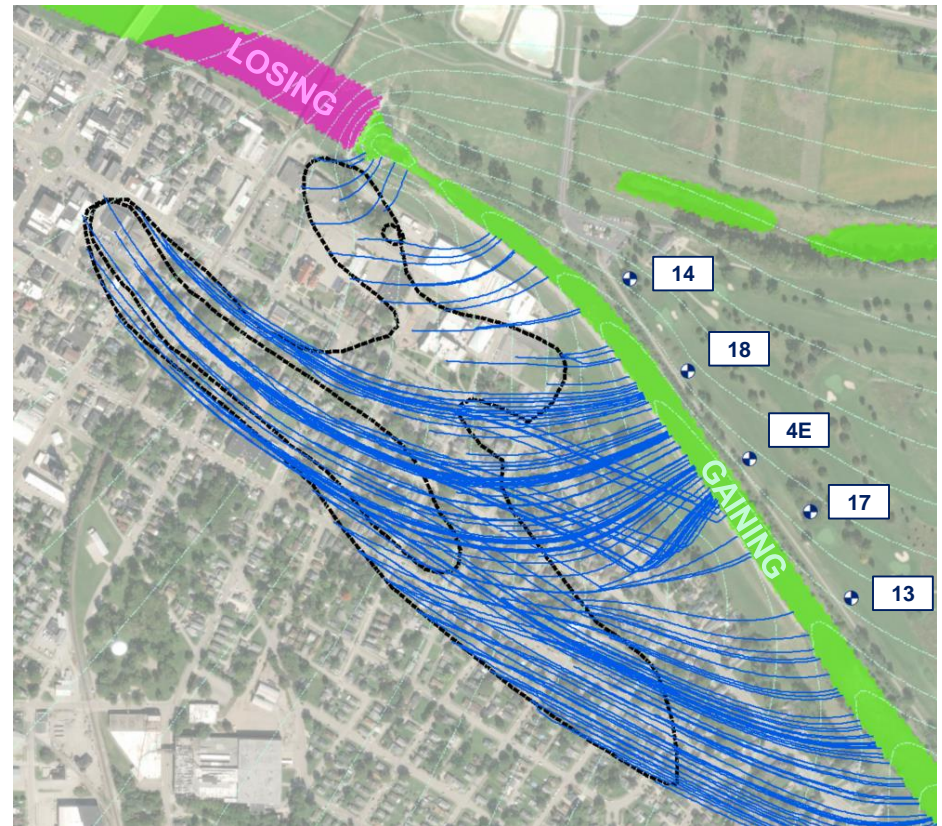
- West Troy PCE



**Particle Count:**

0% to Wells  
100% to River

- East Troy PCE



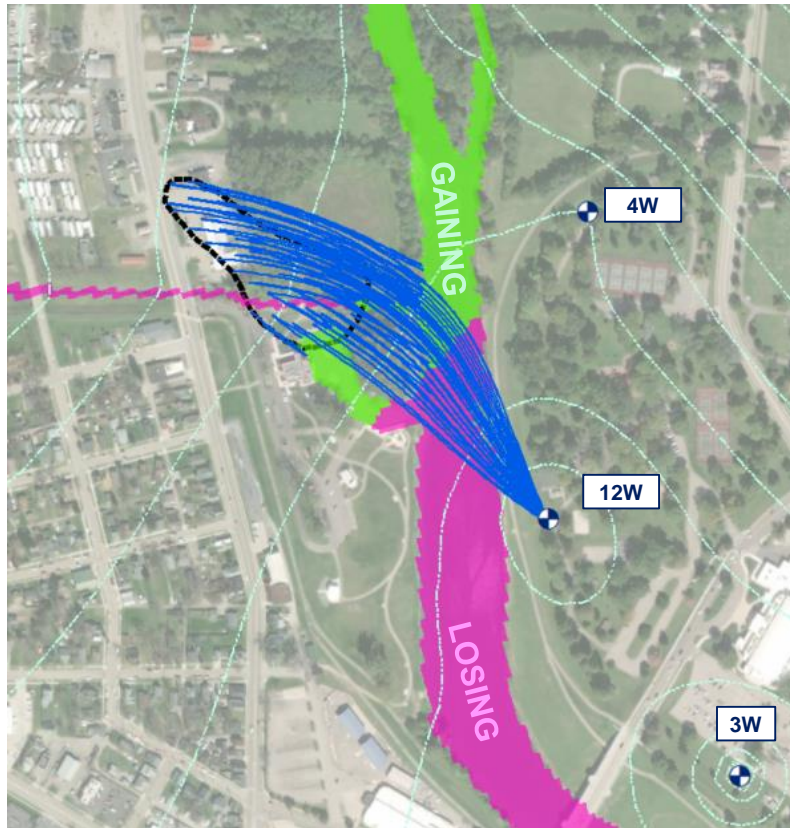
**Particle Count:**

0% to River  
100% to River



# Winter Conditions - Pre Dam Removal

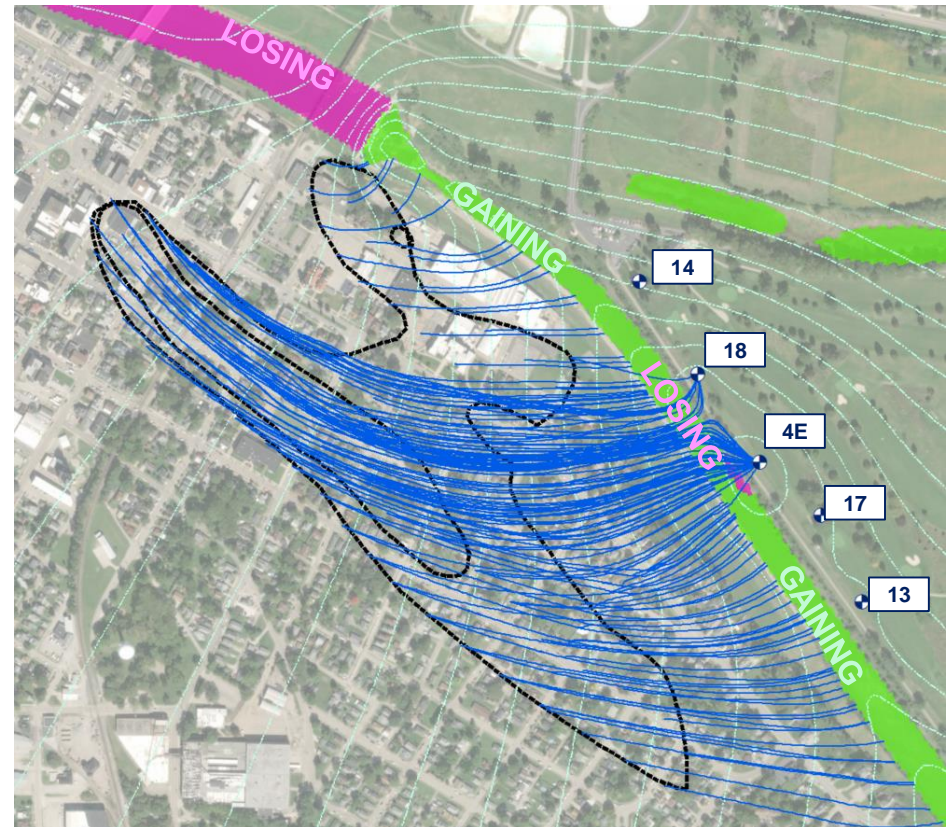
- West Troy PCE



**Particle Count:**

53% to Wells  
47% to River

- East Troy PCE



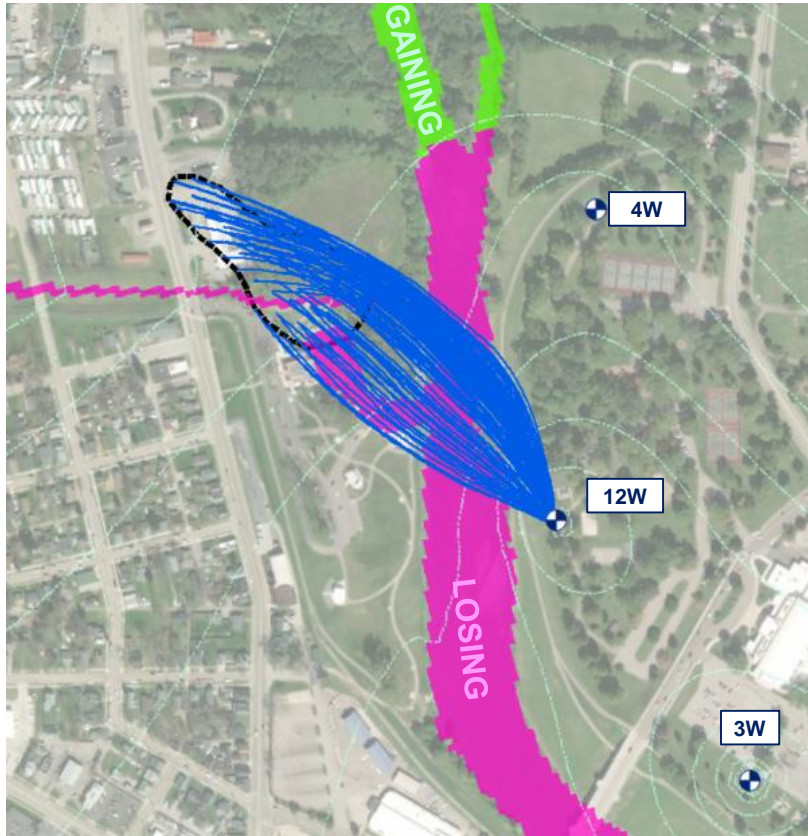
**Particle Count:**

22% to Wells  
78% to River



# Average Conditions - Pre Dam Removal

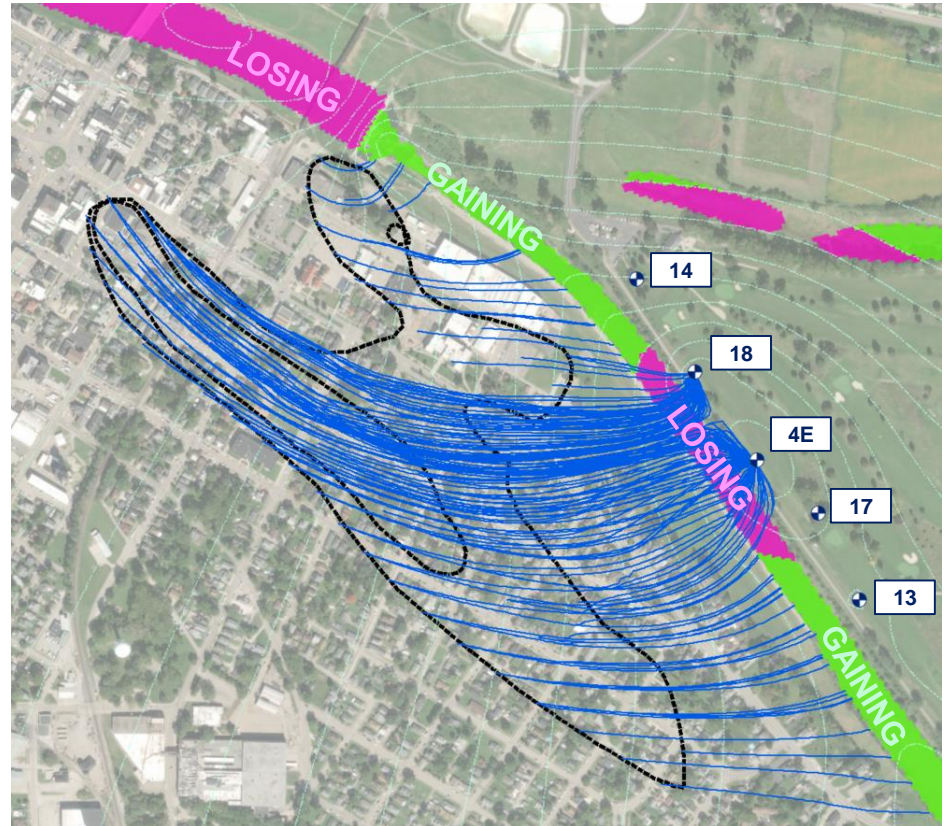
- West Troy PCE



**Particle Count:**

100% to Wells  
0% to River

- East Troy PCE

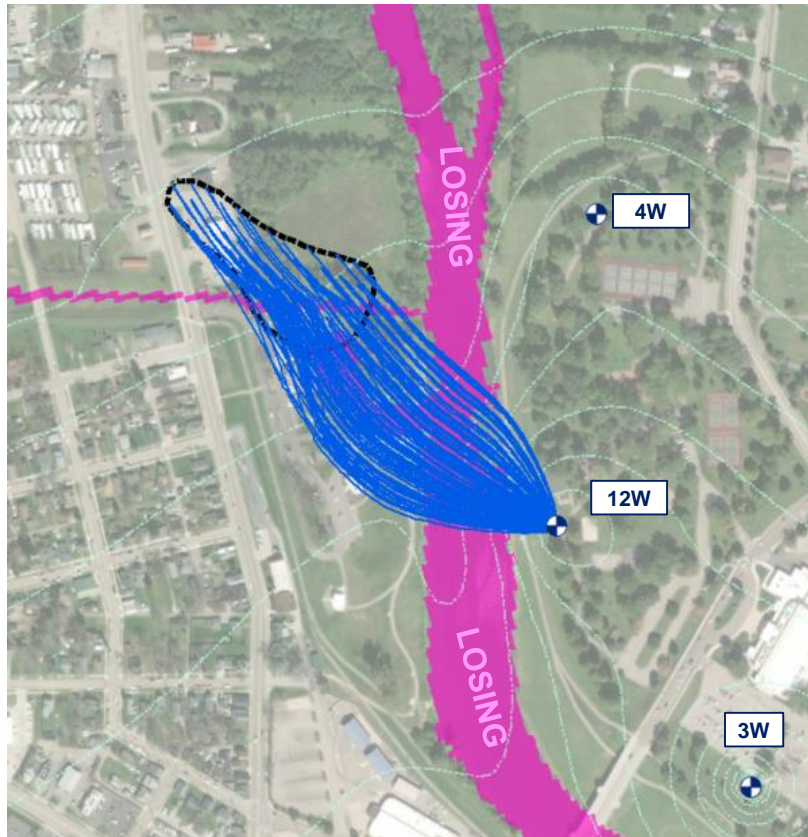


**Particle Count:**

75% to Wells  
25% to River



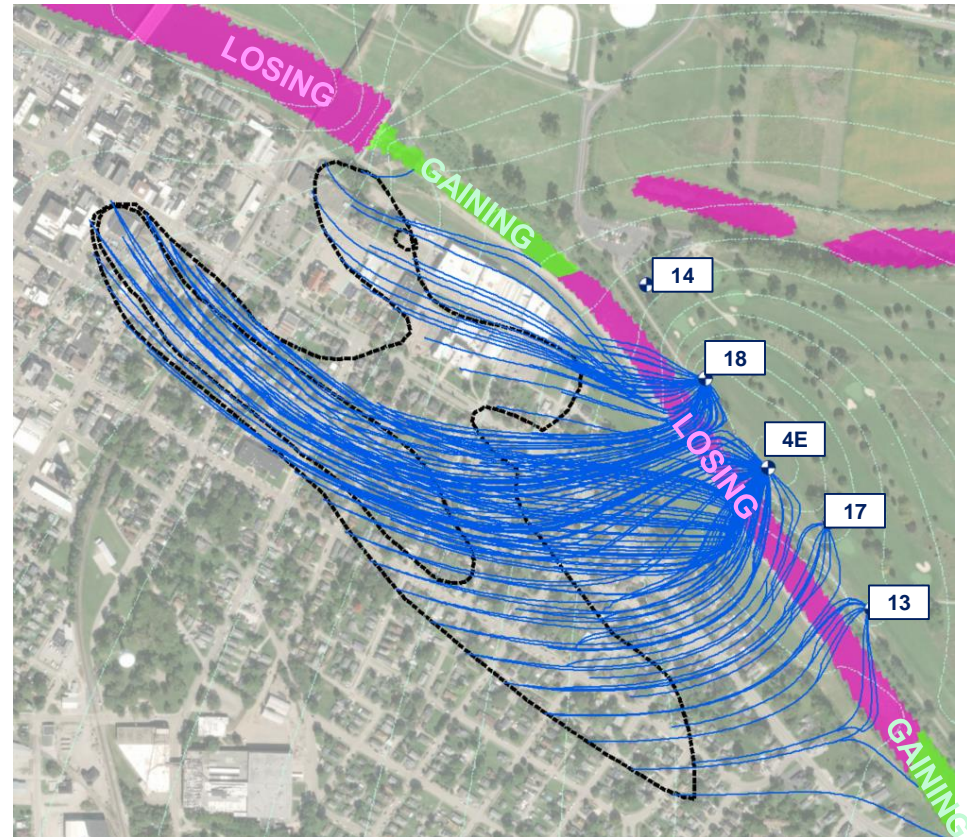
- West Troy PCE



**Particle Count:**

100% to Wells  
0% to River

- East Troy PCE



**Particle Count:**

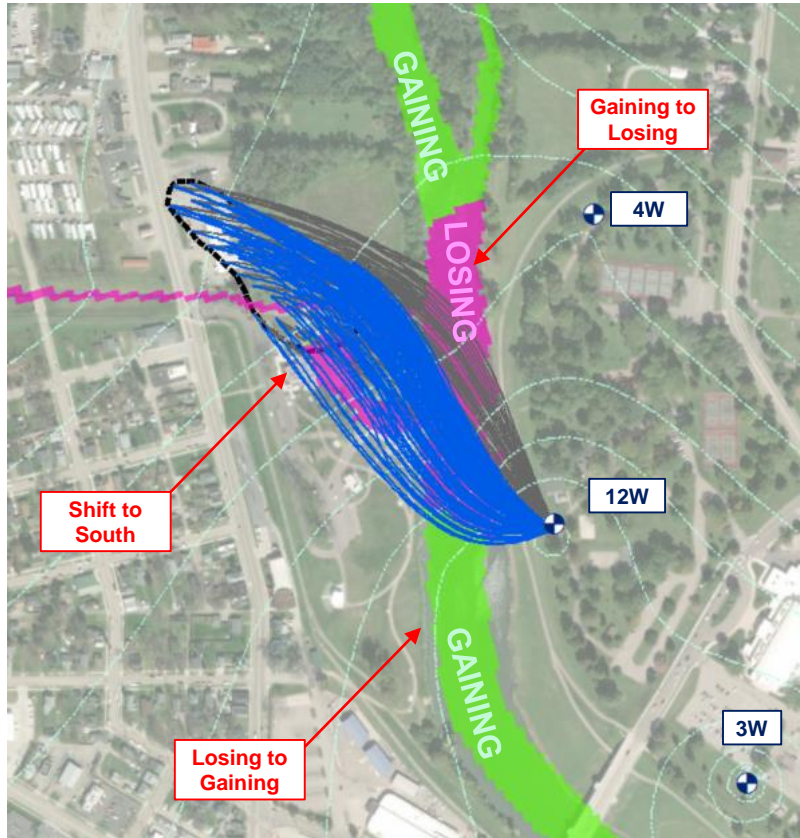
99% to Wells  
1% to River

Pre-Dam Removal (PCE Plume)	West Troy (% to Wells)	East Troy (% to Wells)
No Pumping	0%	0%
Winter	53%	22%
Average	100%	75%
Summer	100%	99%



# Winter Conditions - Post Dam Removal (No Change in River Bed Permeability)

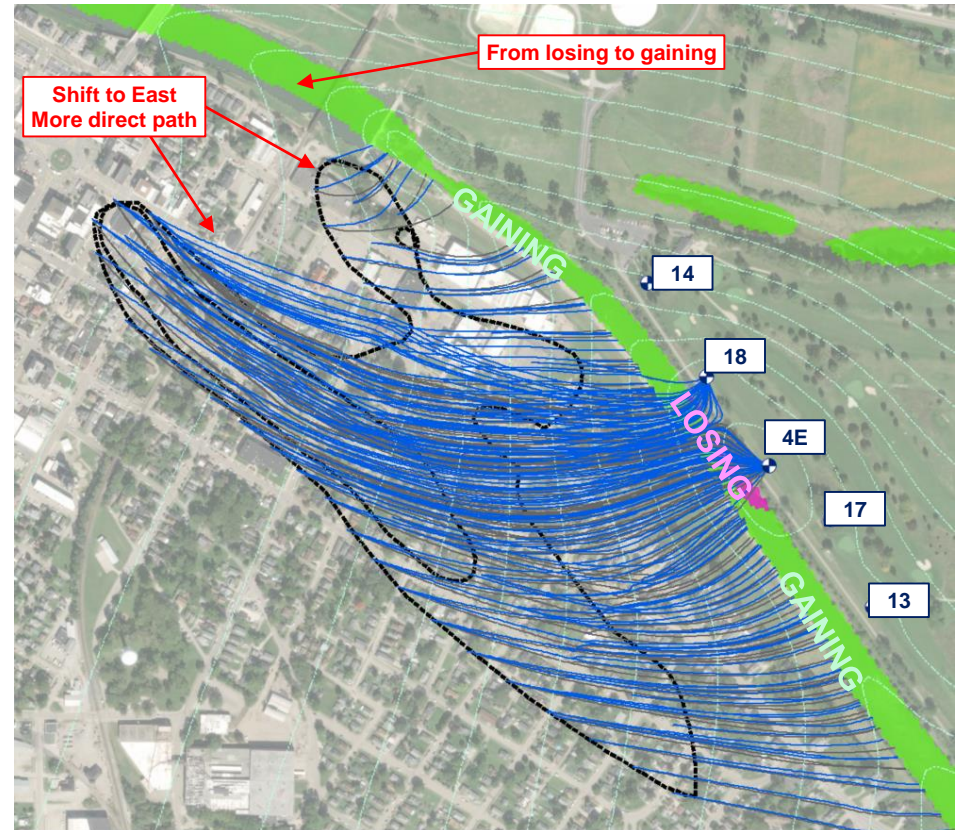
## • West Troy PCE



Pre-Removal  
53% to Wells  
47% to River

Post-Removal  
97% to Wells  
3% to River

## • East Troy PCE



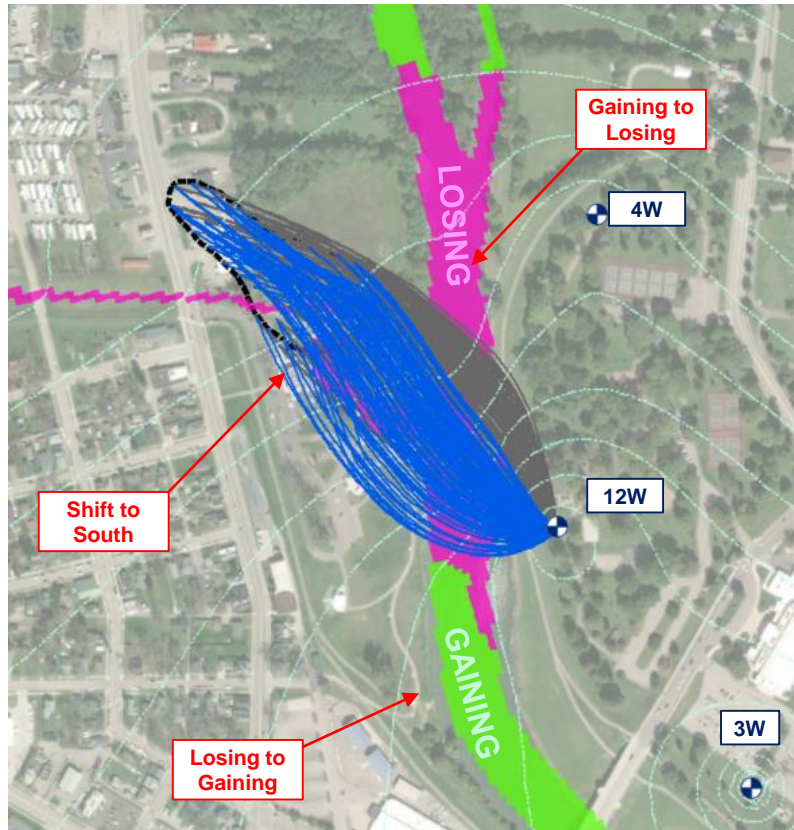
Pre-Removal  
22% to Wells  
78% to River

Post-Removal  
24% to Wells  
76% to River



# Average Conditions - Post Dam Removal (No Change in River Bed Permeability)

## • West Troy PCE



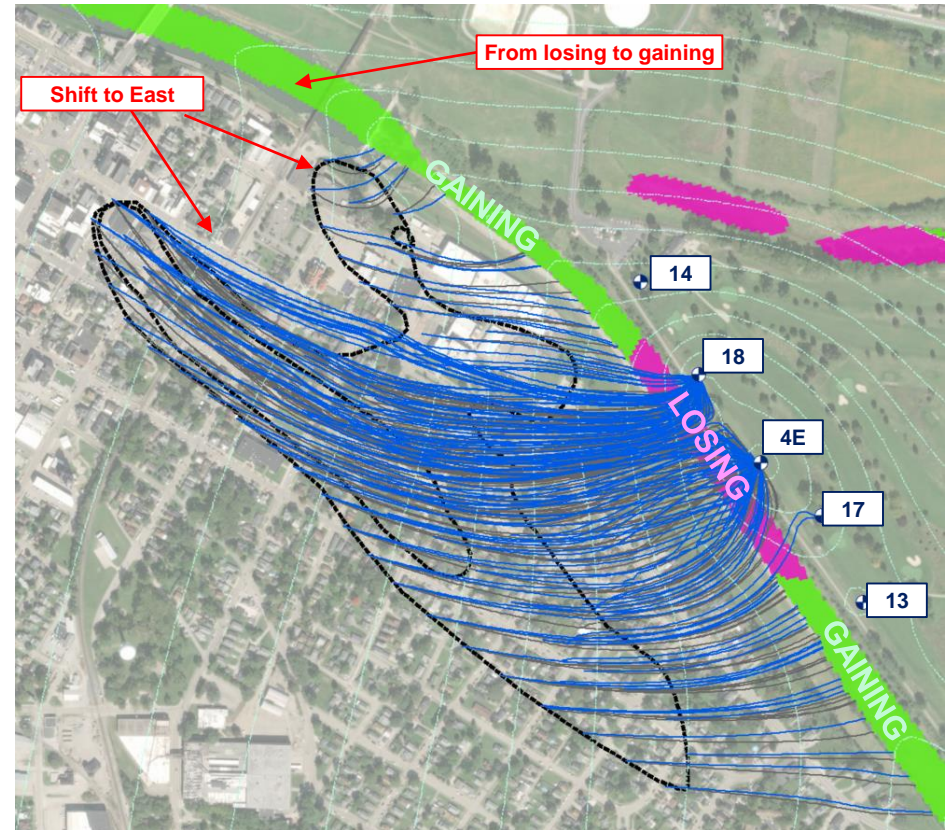
### Pre-Removal

100% to Wells  
0% to River

### Post-Removal

100% to Wells  
0% to River

## • East Troy PCE



### Pre-Removal

75% to Wells  
25% to River

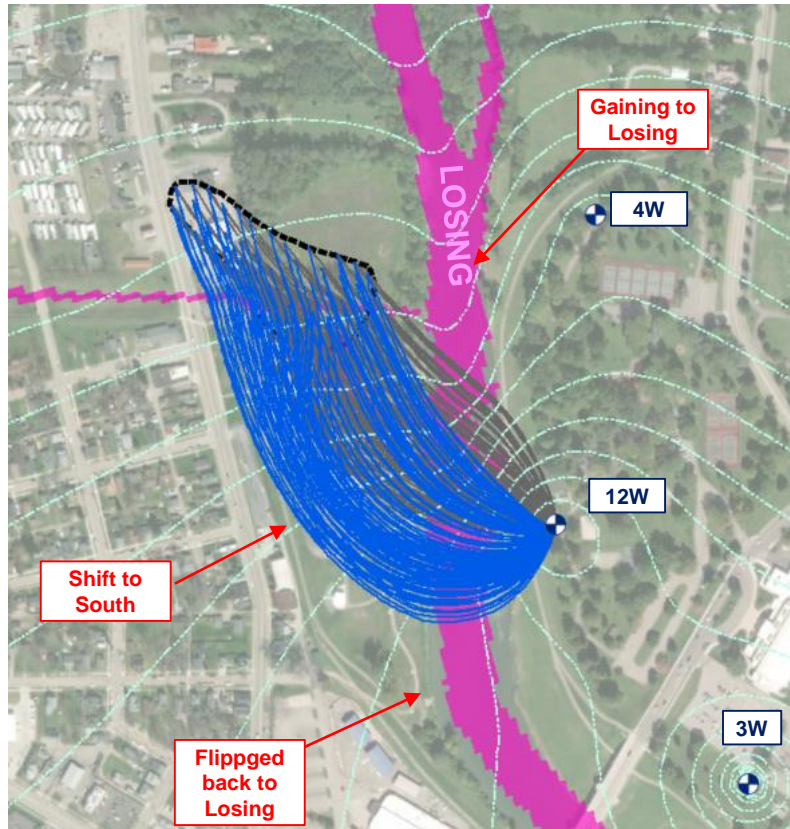
### Post-Removal

82% to Wells  
18% to River



# Summer Conditions - Post Dam Removal (No Change in River Bed Permeability)

## • West Troy PCE



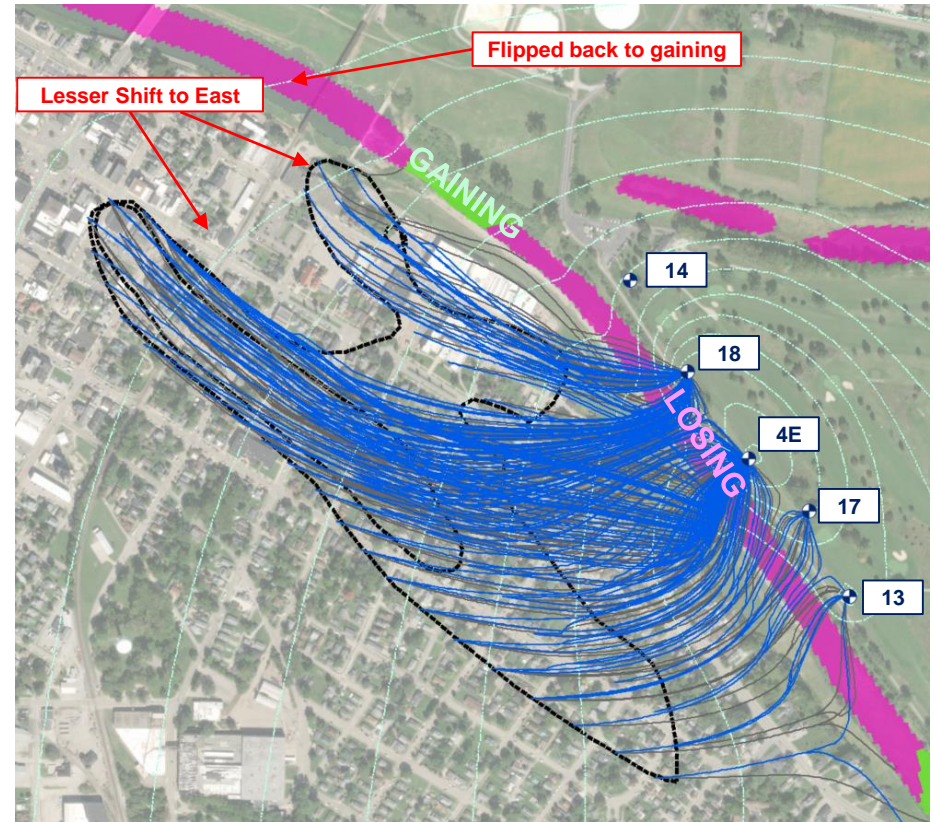
### Pre-Removal

100% to Wells  
0% to River

### Post-Removal

100% to Wells  
0% to River

## • East Troy PCE



### Pre-Removal

99% to Wells  
1% to River

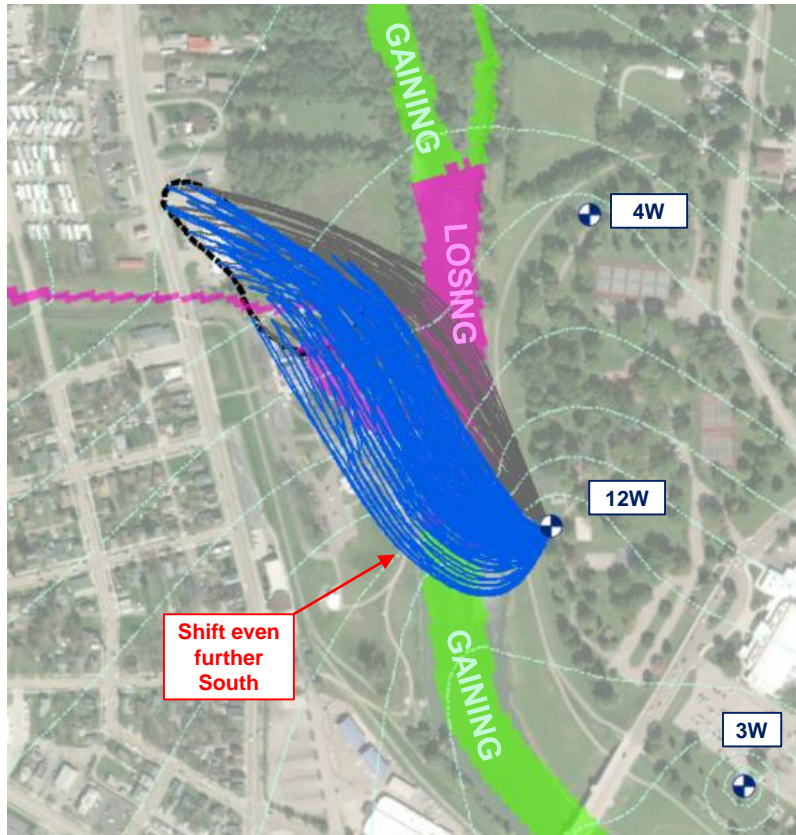
### Post-Removal

>99% to Wells  
<1% to River



# Winter Conditions - Post Dam Removal (Increased River Bed Permeability – Maximum)

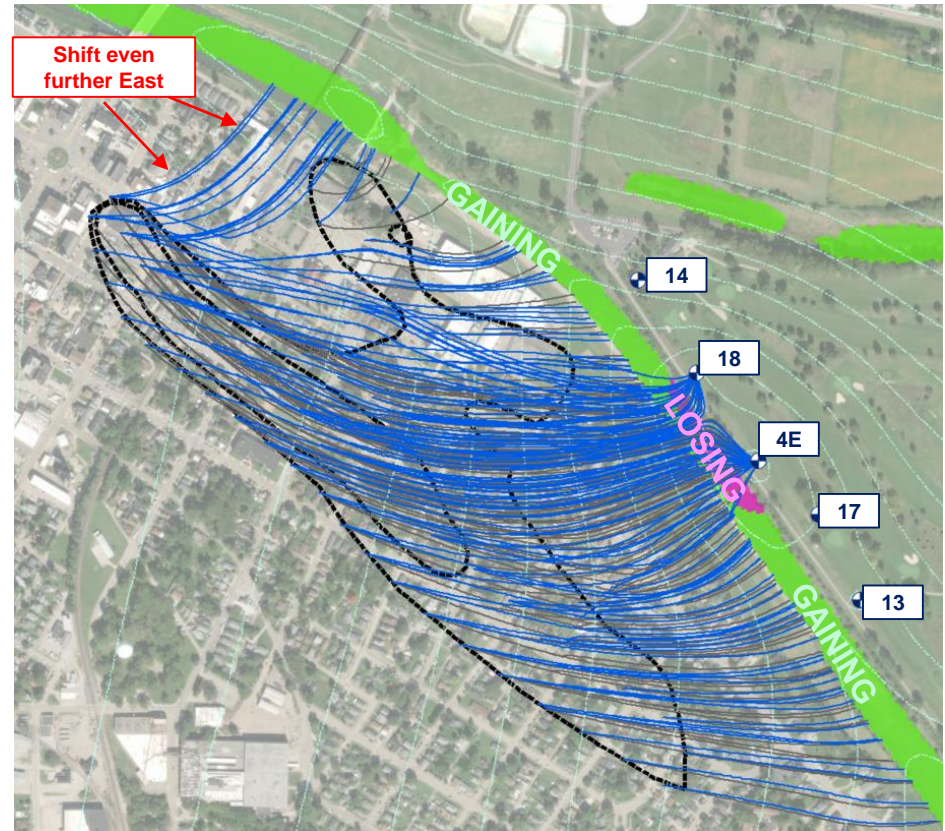
## • West Troy PCE



Pre-Removal  
53% to Wells  
47% to River

Post-Removal  
100% to Wells  
0% to River

## • East Troy PCE



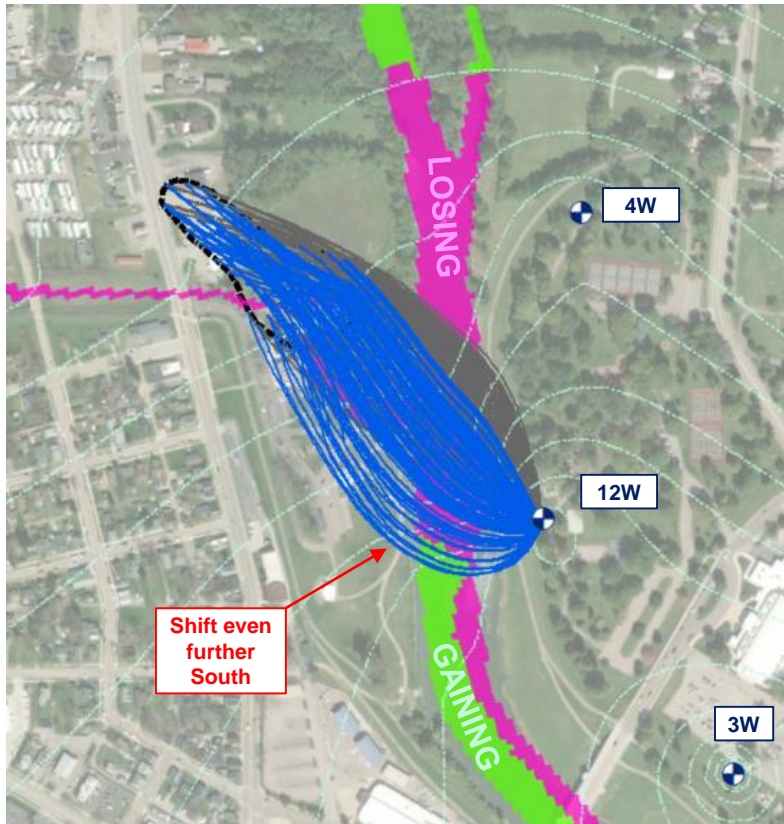
Pre-Removal  
22% to Wells  
78% to River

Post-Removal  
24% to Wells  
76% to River



# Average Conditions - Post Dam Removal (Increased River Bed Permeability - Maximum)

- West Troy PCE



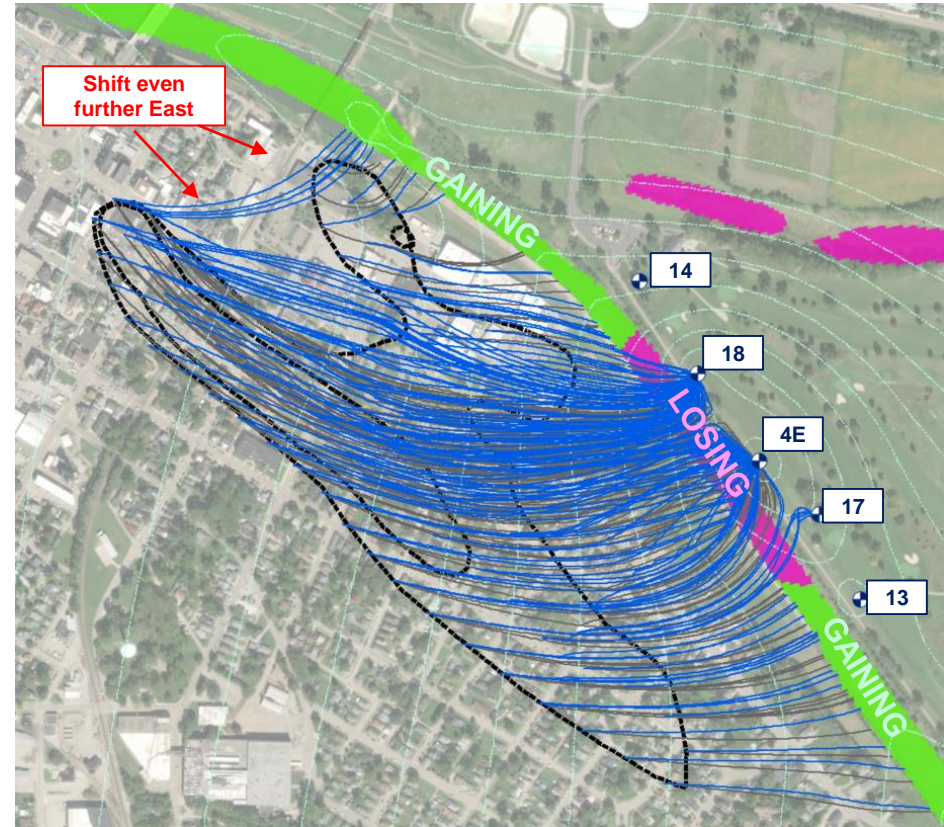
## Pre-Removal

100% to Wells  
0% to River

## Post-Removal

100% to Wells  
0% to River

- East Troy PCE



## Pre-Removal

75% to Wells  
25% to River

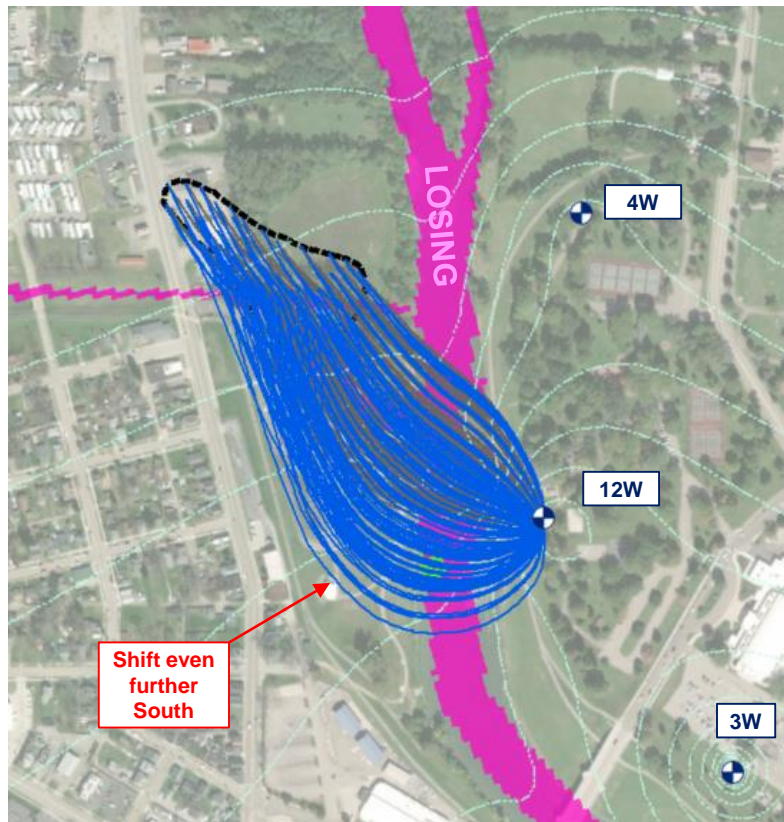
## Post-Removal

83% to Wells  
17% to River



# Summer Conditions - Post Dam Removal (No Change in River Bed Permeability)

## • West Troy PCE



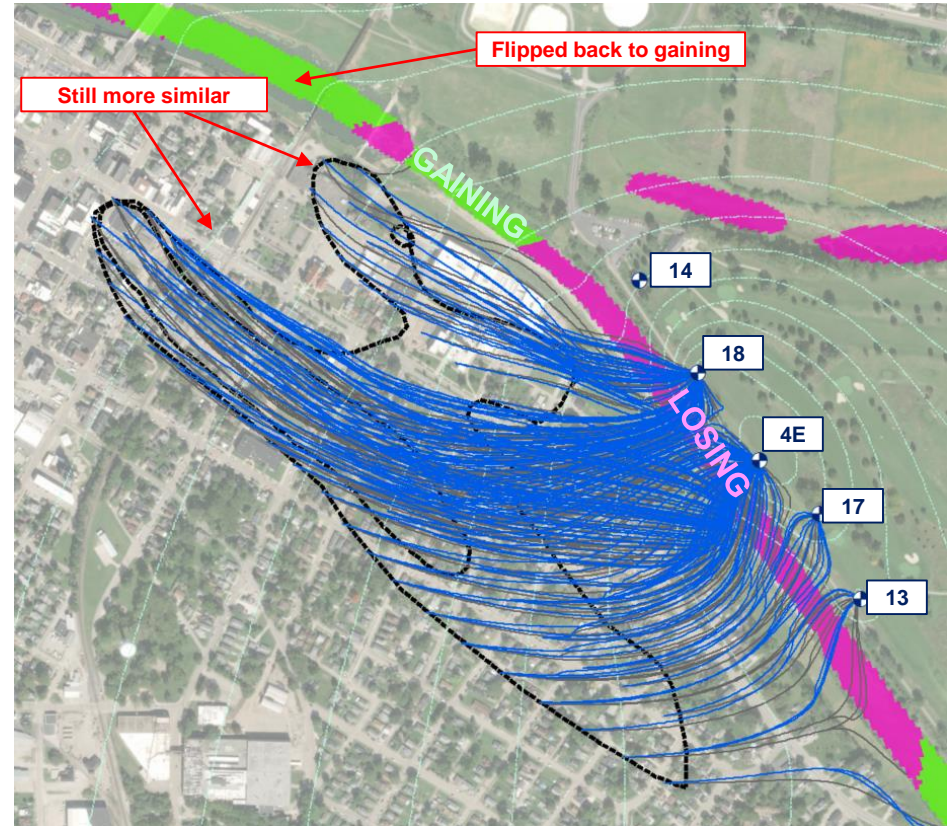
### Pre-Removal

100% to Wells  
0% to River

### Post-Removal

100% to Wells  
0% to River

## • East Troy PCE



### Pre-Removal

99% to Wells  
1% to River

### Post-Removal

>99% to Wells  
<1% to River



# Particle Counts Summary - PCE

<b><u>West Troy</u> (% to Wells)</b>	<b>Pre-Removal</b>	<b>Post-Removal P=0.05 ft/day (current)</b>	<b>Post-Removal P=0.3 ft/day (downstream)</b>	<b>Post-Removal P=2.0 ft/day (maximum)</b>
Winter	53%	97%	100%	100%
Average	100%	100%	100%	100%
Summer	100%	100%	100%	100%

<b><u>East Troy</u> (% to Wells)</b>	<b>Pre-Removal</b>	<b>Post-Removal P=0.05 ft/day (current)</b>	<b>Post-Removal P=0.3 ft/day (downstream)</b>	<b>Post-Removal P=2.0 ft/day (maximum)</b>
Winter	22%	24%	24%	24%
Average	75%	82%	83%	83%
Summer	99%	>99%	>99%	>99%

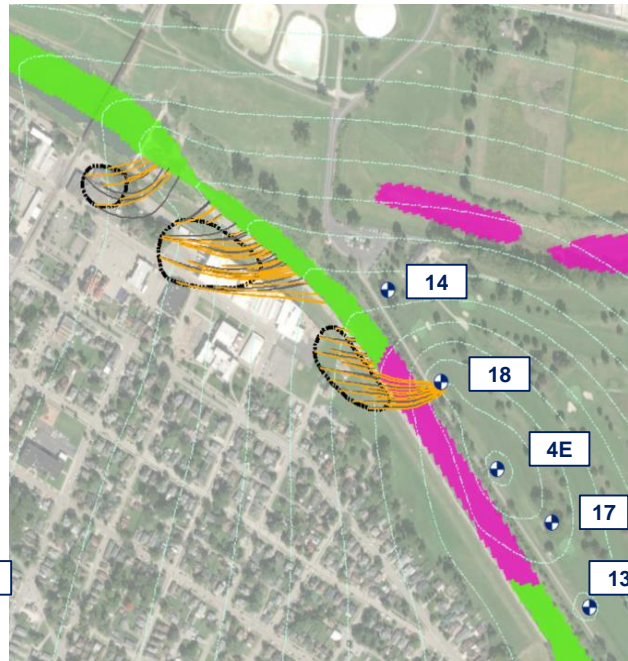
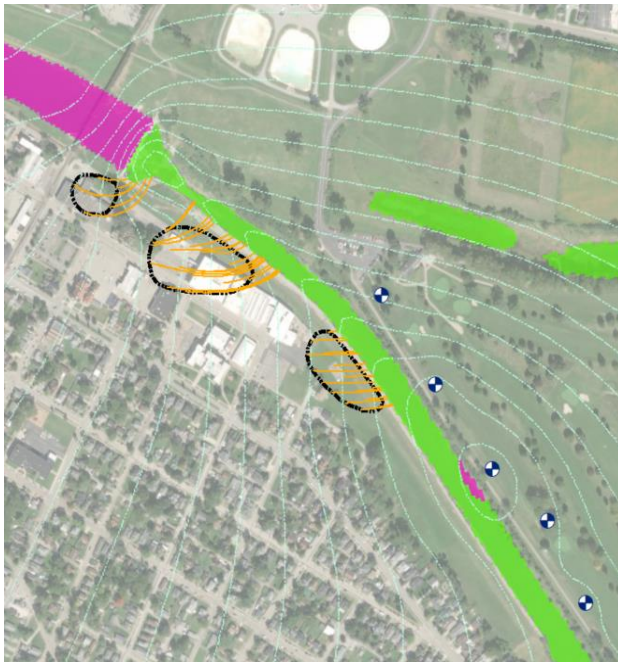
# East Troy cis-DCE Plume

- Maximum concentration in plume is around 30 PPB
- MCL for cis-DCE is 70 PPB
- Very unlikely that cis DCE plume would cause levels above MCL's in production wells.

**Winter**

**Average**

**Summer**



**Particle Count:**

0% to Wells

**Particle Count:**

14% to Wells

**Particle Count:**

88% to Wells



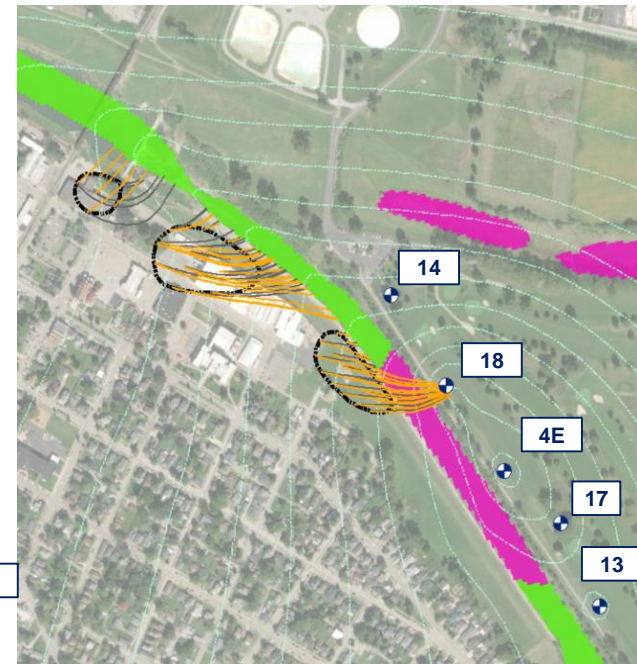
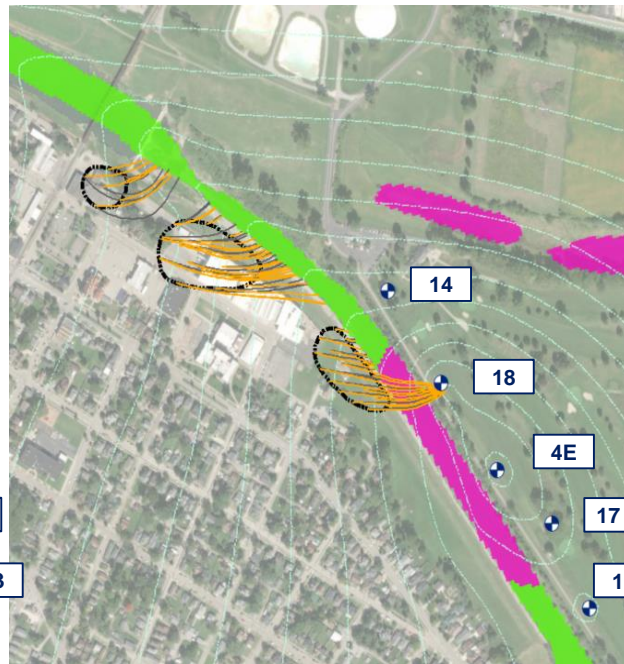
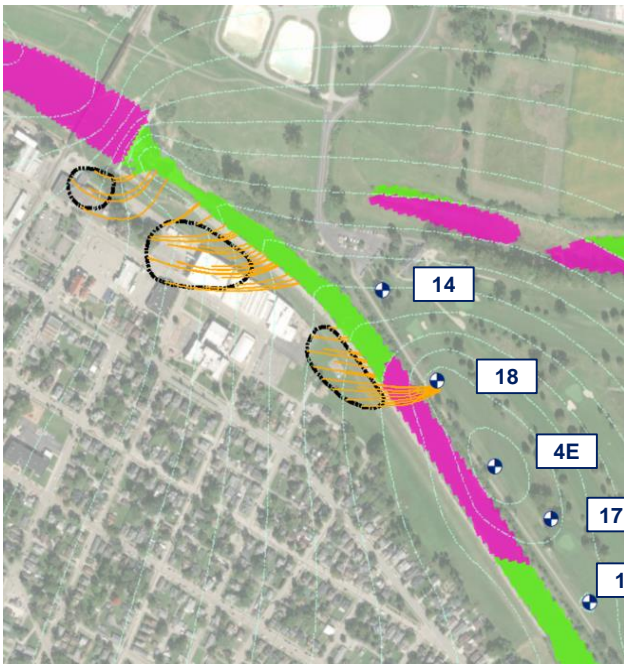
# East Troy cis-DCE Plume

- Maximum concentration in plume is around 30 PPB
- MCL for cis-DCE is 70 PPB
- Very unlikely that cis DCE plume would cause levels above MCL's in production wells.

**Pre-Removal**

**Post-Removal (Curr. Perm)**

**Post-Removal (Max. Perm)**



**Particle Count:**

14% to Wells

**Particle Count:**

25% to Wells

**Particle Count:**

31% to Wells

# Particle Counts Summary – cis DCE

<u>West Troy</u> (% to Wells)	Pre-Removal	Post-Removal P=0.05 ft/day (current)	Post-Removal P=0.3 ft/day (downstream)	Post-Removal P=2.0 ft/day (maximum)
Winter	0%	0%	0%	0%
Average	14%	25%	30%	31%
Summer	88%	100%	100%	100%



- % Water Drawn from River**

<u>West Troy</u>	Pre-Removal	Post-Removal P=0.05 ft/day (current)	Post-Removal P=0.3 ft/day (downstream)	Post-Removal P=2.0 ft/day (maximum)
Average				
* West Well Field	38%	18%	18%	23%
* East Well Field	6%	8%	9%	9%
Summer				
* West Well Field	60%	37%	41%	46%
* East Well Field	22%	27%	26%	25%

- Predicted Change in Water Levels in the Production Wells**

<u>West Troy</u>	Pre-Removal	Post-Removal P=0.05 ft/day (current)	Post-Removal P=0.3 ft/day (downstream)	Post-Removal P=2.0 ft/day (maximum)
Average				
* West Well Field	---	-1.2 feet	-1.4 feet	-1.4 feet
* East Well Field	---	-0.2 feet	-0.3 feet	-0.3 feet
Summer				
* West Well Field	---	-1.7 feet	-1.3 feet	-0.6 feet
* East Well Field	---	-0.3 feet	-0.2 feet	-0.2 feet



- Double Average Well Field Pumping from 4MGD to 8MGD**

<u>West Troy</u>	Pre-Removal	Post-Removal P=0.05 ft/day (current)	Post-Removal P=0.3 ft/day (downstream)	Post-Removal P=2.0 ft/day (maximum)
Average				
* West Well Field	---	-1.9 feet	-1.2 feet	-0.2 feet
* East Well Field	---	-0.3 feet	-0.2 feet	-0.1 feet
Summer				
* West Well Field	---	-3.1 feet	-2.2 feet	0.4 feet
* East Well Field	---	-0.5 feet	-0.4 feet	0.0 feet



## **West Troy PCE Plume:**

- West Troy Plume would likely shift southward
  - Increased potential of bypass around 12W / stripper tower
- Plume able to flow to wells most of the time (except winter)
- Potential for likely small increases in concentrations

## **East Troy PCE Plume:**

- Head of East Troy PCE Plume would like shift eastward
  - Potential to impact additional residential areas
- Some shortening of travel time from high concentration area
- Potential for likely small increases in concentrations

## **East Troy cis-DCE Plume:**

- Concentrations above MCLs are very unlikely
- Mostly dependent on how “losing” the river is
- Potential for some increase in concentrations

## **Recharge Assessment:**

- Decrease in water level is offset by increase in permeability
- Slightly negative influence on recharge to well fields
- Influence will likely be relatively small



# Questions/Discussion

